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THE
CARE *of* TUBERCULOSIS

A TREATISE FOR NURSES, PUBLIC HEALTH WORKERS, AND ALL THOSE WHO ARE INTERESTED IN THE CARE OF THE TUBERCULOUS

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ILLUSTRATED

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TO MY WIFE

WHO THROUGH STUDENT DAYS AND YEARS OF PRACTICE IN THE PROFESSION HAS BEEN THE CONTINUING STIMULUS TO THE BEST EFFORTS OF WHICH I HAVE BEEN CAPABLE

PREFACE

In teaching tuberculosis to student nurses and to graduate public health nurses, the writer has felt the need of a small work covering the essential facts concerning this disease which every nurse and public health worker should know. These women have unusual opportunities to teach patients and others interested in the control of tuberculosis. They are fast becoming intelligent and effective aids in the campaign against this disease. They do a large public service in the relief of much suffering among people who are "sick unto death" and yet often susceptible of recovery. However great the devotion of these nurses, not one of them should be willing to approach the sick bed to render the greatest of human service or to appear in the capacity of the teacher of prevention without first acquiring a full knowledge of the facts concerning tuberculosis. In this small volume an attempt has been made to arrange these facts in such a way as to make this easily accessible. It is

the writer's sincere hope that they may prove useful to those who spend their lives in comforting and curing the sick or in the prevention of tuberculosis. Throughout these pages the writer has sought to eliminate the relatively unimportant. Frequently he has quoted from his own original articles published in the Journal of the Outdoor Life, Minnesota Medicine, the Journal-Lancet, the Public Health Nurse, the Journal of the American Medical Association, and the Journal of the National Education Association.

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J. A. M.

Minneapolis, Minn.

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INTRODUCTION

The statistics of tuberculosis, recited in this volume, tell us that well-nigh 1,000,000 cases of active tuberculosis exist in the United States at the present time and that approximately 100,000 deaths from tuberculosis will occur in this country within the current year. These fateful figures admonish us of the need of such a book as this. The care of these sick and numerously dying people is a matter not merely of professional but of public concern. It is a tragic fact that many of them get no care at all until they are well beyond all human help. In the home the care of each acutely tuberculous individual is a serious duty for some one. In the sanitorium it is the grave problem of the nurse. In home and institution alike it is a question not only of the care of the infected individual but of the protection of the well from the dangers of infection.

The success of the modern crusade against tuberculosis depends not upon the influence

of drugs—for all drugs are impotent in its cure—but upon the early detection of the disease and the hygienic care the patient receives. With the physician rests the diagnosis and the direction of the rational treatment by which its progress may be arrested. With the nurse, whether on private or hospital duty or public health service, rests the doing of the daily details incident to the patient's care upon which his healthful future turns. And yet such a statement does not sum up her whole task. It is she who must intelligently interpret the doctor's instructions; she who must watch the symptoms of change for better or for worse; she who must urge the habitual observance of the hygienic measures by which the patient's resistance may be encouraged and his nutrition maintained. It is she who must know not only the nature of the disease, the science of its prevention, the possibilities of its cure, but she it is who must also know and, knowing, understand the psychology of the sick human with whom she has to deal.

It is these things in their entirety that constitute the care of tuberculosis and it is the

story of these things that this little volume entertainingly and instructively tells. There is nothing in the already large literature of tuberculosis that so fitly fills its particular place. The signal service its author has rendered is foundationed upon his large understanding of this the most fateful of the diseases to which human society has fallen heir; but it is his whole-hearted devotion to the tuberculosis cause, his deep sympathy with its many victims, his keen appreciation of their personal and social problem that carry his message home.

The book should have wide reading among the laity. It is sufficiently popular to appeal to the people at large. It preaches the evangel of good health to which the social consciousness of the public has so widely awakened in the past few years. It is a good text for the student of medicine. It may be useful to the sanitorium director and to the social worker in the hospital and dispensary. Nevertheless, it is the nurse for whom it has a special meaning and a special message. That message cannot fail to reach its mark because its author so well appreciates the nurse

and the possibilities of her service in the tuberculosis field.

The profession of nursing is coming into its own, through many avenues of usefulness, in a very significant way; but nowhere does it find a fuller opportunity of expression than in lifting "the burden of our common lot" in "The Care of Tuberculosis." It is upon the public health nurse—"the missionary of health to the homes of the people"—that the ultimate control of the great white plague principally depends. More power to her saving arm, more grace to her heartening sympathy, more wisdom to her guiding influence over those "who sit in darkness and in the shadow of death."

Richard Olding Beard.

THE CARE OF TUBERCULOSIS

Chapter I

THE HISTORY OF TUBERCULOSIS

There can be little doubt that tuberculosis existed in prehistoric times and that down through the ages, since the dawn of history, it has worked havoc in the human family. On the old Babylonian tablets and in many old Greek manuscripts we see references to this disease and in the Egyptian mummies we find unmistakable evidences of it.

The Nature and Cause of Tuberculosis.— Because of the wasting effect of this disease upon the body it was given the name of the Greek word *phthisis*, which means a wasting, and later the name *consumption*, derived from the Latin word meaning to use up or to waste. Hippocrates (460–376 B. C.) defined phthisis as an ulceration and suppuration of the lung. He believed that there were the following

four causes of this disease: (1) Unresolved pneumonia, (2) discharges from the pharynx entering the lungs through the trachea and becoming stagnant, (3) blood spitting, (4) empyema. One of Hippocrates' contemporaries, Isocrates, believed that phthisis is contagious.

Galen (130–200 A. D.) stated that phthisis is due to ulceration and that its chief causes are: (1) direct injury, (2) rupture and hemorrhage from strain and inflammation. From the following quotation it is evident that he agreed with Isocrates regarding the contagious nature of the disease: "It is dangerous to live with consumptives and with those whose foul breath imparts a heavy odor to the rooms in which they lie."

Celsus was of the opinion that phthisis is an hereditary disease.

Superadded to the beliefs of these more outstanding ancient physicians were other absurd ideas concerning the cause of tuberculosis. Some thought that the disease was caused by a vicious disposition of the body juices; others, that it was due to a strange ferment; and still others, that it was caused

by a sharp corroding humor falling from the brain upon the lungs.

Then followed a vast expanse of time—more than fifteen hundred years—during which there was no change of ideas and no progress in the real knowledge of consumption. During the Dark Ages medical and scientific study fell into decline. In this period the lamp of science was extinguished throughout the known world except in Arabia, where it was permitted to burn in very dim fashion.

The next advance in our knowledge of consumption was made by Sylvius (1614–72), who announced that phthisis is not the only disease that causes wasting of the body; therefore only the wasting which follows ulceration of the lung should be called phthisis. Sylvius actually saw tubercles in the lungs, but he did not understand their structure. He believed they were due to swollen glands which under normal conditions were invisible. He described the condition which we now know as miliary tuberculosis, but did not recognize its pathology.

Morton (1635–96) declared that phthisis is a very prevalent disease; in fact, he ques-

tioned whether any one could die without having had it. He concluded that tubercles are found in the lungs in all cases of consumption and pointed to the fact that tubercles often heal spontaneously.

In 1720 Marten published a book entitled "A New Theory of Consumptions," in which he said: "The *original* and *essential* cause, then, . . . may possibly be some certain species of *animalcula* or wonderfully minute living creatures, that, by their peculiar shape or disagreeable parts, are inimicable to our nature; but, however, capable of subsisting in our juices and vessels, and which . . . may, by their spontaneous motion, and injurious parts, stimulating, and perhaps wounding or gnawing the tender vessels of the lungs, cause all the disorders that have been mentioned." It is really remarkable how well Marten's theories, formulated more than one hundred and sixty years before the true cause of tuberculosis was discovered, coincide with our present knowledge.

Although Sylvius had actually described miliary tuberculosis, Bayle (1774–1816) was the first to use the word "miliary." In 1810 he

coined also the word *tuberculosis*, and since that time the words "consumption" and "phthisis" have gradually given way to this new name. Bayle was also the first to speak of *tuberculous diathesis* or *disposition*. This idea he based on the fact that he had observed the simultaneous appearance of tuberculosis in various organs of the body.

Laënnec (1781–1826) did much to advance our knowledge of phthisis. In addition to making it possible to study the tuberculous patient more carefully than ever before, by the use of the stethoscope, which he invented, he came to the conclusion that all phthisis is tuberculous. Moreover, he pointed out that, contrary to the belief of his predecessors, hemorrhage is not the cause of tuberculosis, but, rather, tuberculosis is the cause of hemorrhage.

The invention of the *microscope* and the rapid perfecting of this instrument, later, made it possible to see and actually study objects even smaller than $\frac{1}{25000}$ inch in diameter. Virchow (1821–1902) took advantage of his opportunities and studied tuberculous lesions in considerable detail under the microscope.

By this means he was able to study the smallest tubercles and to actually describe the appearance of the cells and other substances entering into their composition. From this time on, the microscope was used very extensively in delving into the secrets of tuberculosis and finally proved to be the instrument which brought within range of human vision the real cause of tuberculosis.

Experimental studies in tuberculosis apparently were neglected until the time of Klencke, who, in 1843, produced tuberculosis in rabbits by injecting into their veins tuberculous material. Later he showed that cow's milk is capable of transmitting tuberculosis. Probably because Klencke could not convince anyone of the reliability of his statements experimental work was again neglected for a period of approximately twenty years. In fact, it was not until Villemin, in 1865, confirmed the work of Klencke by inoculating rabbits with the sputum of tuberculous people and even with the tuberculous tissues of the cow, producing tubercles in the lungs of every rabbit so treated, that any attention was paid to this method of study. The appreciation

of Villemin's work even was so slight that no further experimental work was done until Cohnheim, in 1877, repeated and amplified Villemin's experiments. He injected tuberculous material into the anterior chamber of the eye of the rabbit where he could watch the actual development of tubercles from day to day.

About this time, practising medicine in the country in Germany, was a physician by the name of Robert Koch, who had become much interested in the study of tuberculosis. He had some knowledge of bacteriology gained from Pasteur; he had at his command the high-power microscope and certain stains and dyes; and he himself was endowed with an investigative mind. In 1882 Koch announced that he had discovered the real cause of tuberculosis and he was able at the same time to demonstrate by aid of the microscope certain germs which he designated as *tubercle bacilli.* In order to prove his statements Koch set to work to isolate the tubercle bacilli from tuberculous material. He succeeded in doing this and, later, in growing them in pure cultures. Next he inoculated material from his pure

cultures into 217 animals, with the result that not one animal failed to develop tuberculosis.

Koch's work has been confirmed many times and there is now no doubt that tuberculosis only develops in the presence, as its provoking cause, of that small germ known as the tubercle bacillus.

The Diagnosis of Tuberculosis

The ancient physicians were compelled to make their diagnoses very largely from *observation* of the patient's general condition. One of their most outstanding observations was the wasting effect of the disease, hence the original name "phthisis" which Hippocrates ascribed to it. Apparently the ancient physicians diagnosed phthisis only in its advanced stages.

The *symptoms* of phthisis became, of course, of much use in the diagnosis of the disease. Sylvius called especial attention to the following four symptoms: (1) *wasting*, (2) *cough*, (3) *spitting of pus*, (4) *hectic fever*. Morton called attention to another symptom which phthisical patients often experience, namely, *difficulty in breathing*. Marten added such

symptoms as *night-sweats*, *loss of appetite*, *loss of strength*. He says of these patients: "So that at length, through a total decay of their muscular or fleshy parts and an entire loss of strength, the lamp of life burns dimly, and, for want of proper fuel, is soon after quite extinguished."

It was not until 1761 that Auenbrugger described his method of *percussion*, which consisted of producing vibrations and sounds by tapping over the surface of the chest. He found that these vibrations and sounds differed a great deal according to the condition of the underlying lung tissue. Since Auenbrugger's discovery percussion has been used very extensively in the diagnosis of tuberculosis.

During all the past centuries tuberculosis had been studied without the aid of the stethoscope. It was left for Laënnec to invent this instrument. In 1819 he described the crude *stethoscope* which he had just invented by making a cylinder of paper, one end of which was applied to the patient's chest while the opposite end was applied to one of the examiner's ears. This greatly amplified the

sounds coming from within the chest, and of so outstanding aid has the instrument proved to be in the diagnosis of tuberculosis that it has evolved from its crude original state to its present highly elaborated forms. Indeed, the stethoscope may be spoken of as one of the most if not the most important instrument commonly used in the diagnosis of tuberculosis today.

The experimental work of Klencke, Villemin, Cohnheim, Koch, and many other more recent investigators has brought to light another valuable aid in diagnosis, namely, the *inoculation* of questionable tuberculous material from the human to the animal; the development of tuberculosis in the animal being reasonably good proof of the existence of tuberculosis in the suspected person.

Koch's discovery of the *tubercle bacillus*, with the subsequent perfecting of the methods of staining and differentiating tubercle bacilli from other kinds of germs, has given us the one method of diagnosis which is acceptable to the courts.

The discovery of the *x*-ray by Roentgen in 1895 and the rapid evolution of its uses have

given us a new and very valuable aid in the diagnosis of tuberculosis.

The Treatment of Tuberculosis

Hippocrates was of the opinion that tar was very valuable in the treatment of tuberculosis, hence he gave his patients large quantities of this substance. Like Galen, Willis, Sylvius, and others, Hippocrates advised the bleeding of phthisical patients. Others advocated strongly such methods as severe purging and vomiting, sweating, bathing, blistering, inhalations, external applications to the chest, etc. It seems that nearly every drug in the Pharmacopeia has been tried in the treatment of consumption at some time or other in the past. Indeed, Marten, as early as 1720, said: "Of all the distempers that afflict mankind, there's not one for the cure of which more remedies have been appropriated and invented than for a phthisis or consumption of the lungs." All kinds of medical imitators and fakirs have taken their turn at the treatment of consumption, only to be hurled violently upon the rocks of failure and dashed to pieces.

At a very early time Galen and Celsus ad-

vocated a milk diet, out-door living, and a change of climate. These ideas were so far in advance of their time that they were ignored by others. In fact, for nearly twenty centuries most patients were treated in tightly closed and stuffy rooms.

About 1670 we find Sydenham recommending horseback riding for phthisical patients. However, in other respects, his treatment did not differ from that of his contemporaries. In 1720 Marten advocated many principles of dietetic and hygienic regimen which are in practice to this day.

About 1830 Dr. George Bodington, living in a little village in Warwickshire, England, advanced some modern views concerning the treatment of tuberculosis. He advocated plenty of wholesome food, rest, and cold dry air. One of his prescriptions reads as follows: "Fresh air to make the patient breathe, good wine to bring down his pulse, a good dinner to make him fat, and an opium pill to make him sleep." Although wine is not recommended, the remainder of Bodington's prescription is acceptable today except that the narcotic is used only in special cases and con-

ditions. So firmly was Bodington convinced that he was using a rational treatment in tuberculosis that he established the first hospital for the treatment of this disease. In this hospital he effected many cures, but unfortunately for him he published in 1840 an article entitled "An essay on the cure of pulmonary consumption, on principles natural, rational, and successful." This article seemed so irrational to Bodington's unprogressive contemporaries that they greeted it with fierce and bitter opposition. In spite of his powers of close observation and his unusual ability to analyze facts and to act upon his knowledge, without allowing the opinion of others to overrule his judgment, Bodington finally gave up the treatment of tuberculosis and converted his hospital into an insane asylum. Thus, again, scientific progress in the treatment of tuberculosis was retarded for nearly two decades.

It was not until 1859 that anyone was so fearless as to open another hospital for the treatment of tuberculosis. At this time Brehmer opened a sanatorium in Görbersdorf in the Black Forest of Germany. He was able

to overcome current opposition and it is upon the type of his institution that most of the sanatoria of the world were developed. Since Brehmer believed strongly in climate and altitude and could not be convinced of the value of long rest and fresh air in the treatment of tuberculosis, it was left to one of his patients, Dettweiler, to prove to and to convince others that climate and altitude are of little or no importance and that rest and fresh air are the really important factors in the treatment of this disease. Like Brehmer, he believed in plenty of good wholesome food, but he did not employ forced feeding so extensively as Brehmer.

When in 1873 Dr. E. L. Trudeau, a young physician of New York City, became afflicted with consumption and was sent to the Adirondack Mountains, it was not because there was any known successful treatment in that place; for in those days, as Dr. Trudeau later stated, "pulmonary consumption was considered as absolutely fatal." When Dr. Trudeau arrived at Paul Smith's, in the Adirondacks, he went to bed for rest because he was too ill to be up, he ate plenty of wholesome food

because he was hungry, and he lived in the fresh air day and night because in the summertime such air is more comfortable than that of closed rooms. A little later he also found much delight in fishing and hunting; a great deal of which he did while quietly resting in a boat in the open air and sunshine. Probably Dr. Trudeau did not know, nor did any other physician in this country know, that he was only aiding nature and thus giving her an opportunity to heal the disease. Had he then continued to rest, to take proper food and fresh air over a longer period of time, he would in all probability have so completely recovered that one often wonders if he would have made the tremendously outstanding contributions to our knowledge in the treatment of tuberculosis that he later made; but as soon as he had improved considerably he gave up the treatment. He had accidentally found a method of relieving his symptoms and whenever they reappeared he was forced back to that method.

In 1882 Dr. Trudeau read in the English "Practitioner" an account of Brehmer's Sanatorium in Silesia. The treatment of pul-

monary consumption employed there was apparently very similar to that which Dr. Trudeau had discovered to be effective in his own case. He therefore became very much interested and so impressed with the idea that he caught the vision of building a sanatorium in America. He donated his services, immediately began to raise money, and, early in 1885, completed the first cottage, which was at once occupied by two patients. This was a tremendous undertaking in those days and, as Dr. A. K. Krause recently expressed it, "The sanatorium was not always a lusty youngster, able to take care of itself." One can imagine how difficult it would be, even today, for an ill person to build an institution, by private subscriptions, in a wilderness 40 miles from a railroad for the purpose of improving the health or effecting a cure of persons suffering from a disease universally considered as absolutely fatal. Naturally, progress was slow at the beginning, but after a few years discharged patients, who had been greatly improved or cured of their symptoms of tuberculosis, went forth as volunteer missionaries to spread the news of the won-

derful treatment to their relatives, friends, and home physicians. Since the change in their own condition was so obvious they had very little difficulty in convincing the home folk of the efficacy of the new treatment of consumption. The work of these missionaries, together with the enthusiasm, persistence and untiring efforts of Dr. Trudeau and his associates, gave sufficient impetus to the new crusade; for, in spite of all apparent handicaps, the sanatorium gradually grew, until today it is the one institution in America to which all others of its kind should, as most of them do, look for guidance.

Fortunately, the new treatment for consumption was not long confined to Saranac Lake, New York. Committees in various parts of America were set to work investigating the efficacy of sanatorial treatment and the advisability of building institutions in other places, with the result that millions of dollars were spent in building and maintaining sanatoria; so that today there are only two States in the Union which do not have, within their own borders, one or more sanatoria for the treatment of tuberculosis; and

that, in the aggregate, these sanatoria number more than 600. Unquestionably this method of treatment has contributed not a little to the decrease of the death-rate from tuberculosis which this country has witnessed in the past few decades.

The need for graduate nurses in waging the fight against tuberculosis was understood, but it was not until 1904 that the first school in the world for training tuberculosis nurses was opened at the Phipps Institute in Philadelphia. Out of this small beginning have grown several special courses in the nursing of tuberculosis and the great aid which especially trained nurses have contributed to the treatment of tuberculous patients has created a tremendous demand for them in the various phases of remedial work.

The Organized Tuberculosis Movement

A history of tuberculosis must needs give due consideration to the great tuberculosis movement in the United States. Dr. S. A. Knopf has recently written an excellent book on "A History of the National Tuberculosis Association." To this book I am indebted

for many of the facts that follow, and I want to recommend strongly that all those who are interested in tuberculosis read Dr. Knopf's history, which may be secured through the National Tuberculosis Association. As early as 1857 the first free hospital for the treatment of pulmonary tuberculosis was established in Boston. In 1875 the first private sanatorium was established. In 1885 Dr. Trudeau opened the first sanatorium for the poor and for those of moderate means. The Massachusetts State Sanatorium, located at Rutland, was opened in 1898 as the first state sanatorium. Only one year previous to this the first municipal hospital for poor consumptives was established in Cincinnati, Ohio. As early as 1899 the United States Government established a United States Army General Hospital at Fort Bayard, New Mexico. This hospital was for discharged tuberculous soldiers, officers of the army on the active or retired list who have tuberculosis, and for wives of officers and army nurses who are tuberculous. This particular sanatorium recently became one of the Veteran's Bureau hospitals and is no longer available for tuberculous patients of the reg-

ular army service. However, the government has provided adequate facilities in other hospitals for these patients. From this beginning, in these few sanatoria, the sanatorium movement has grown until we now have approximately 600 sanatoria.

In 1892 the Pennsylvania Society for the Prevention of Tuberculosis was formed and, ten years later, a tuberculosis organization was created in New York City. As similar associations began to spring up in various parts of the country it became evident that a great central organization was needed to co-ordinate their activities and to extend the tuberculosis crusade. In 1904 the National Association for the Study and Prevention of Tuberculosis was organized, with Dr. E. L. Trudeau as president. The first great problem which this new organization encountered was that of financial support. It was indeed a happy moment when in 1908 the Red Cross came to the rescue and the Red Cross Christmas Seal was inaugurated. Although at that time no one anticipated that the seal would become a source of great financial revenue, it has proved to be the most important and

in some instances the only means of placing the tuberculosis work in this country on a sound financial basis. Indeed, more than $25,000,000 has been realized from the seal sales in the United States. The success of the Christmas seal and of the many other activities of the National Tuberculosis Association has been due in no small part to the earnest and conscientious work of Dr. Philip P. Jacobs, who has labored diligently in its service since 1908. At the present time Dr. Jacobs is Publicity Director of the Association and is Managing Editor of one of the association's publications, the Journal of the Outdoor Life. Recently he has published a splendid book, entitled "The Tuberculosis Worker," which should be in the library of every person engaged in tuberculosis work.

After the seal sale of 1919 the Red Cross decided to withdraw its name and emblem from the Christmas seal, primarily because it wished to concentrate its efforts upon its own work in the postwar days. Since 1920, therefore, the Red Cross emblem and name have been omitted and the double-barred cross substituted. It is now known as the Tuber-

culosis Christmas Seal. In addition to its importance in financing tuberculosis work, the Tuberculosis Christmas Seal has a tremendous educational value. Every nurse and public health worker can do much to make each Tuberculosis Christmas Seal sale campaign a success.

As the sanatorium idea gained in favor with patients and all those entrusted to their care, there appeared a need of a special organization for sanatorium workers. Such an organization was effected in 1905, under the name of The American Sanatorium Association, and the first meeting was held in New York City. With 19 members in 1906, this organization has grown to a membership of approximately 250. In addition to its many other activities, it has done much to bring about uniformity of sanatorium regimen and classification of patients.

In 1916 the Metropolitan Life Insurance Company offered to place at the disposal of the National Association for the Study and Prevention of Tuberculosis $100,000 for the purpose of conducting a community experiment in the control of tuberculosis. This offer

was accepted and the experiment was launched in Framingham, Massachusetts, in December, 1916, with Dr. Donald B. Armstrong as executive officer. This experiment at Framingham has revealed many important facts about tuberculosis. For example, it has shown that approximately one per cent. of the people are suffering from active tuberculosis and that there are in any community nine or ten active cases for every death during the year. Moreover, this experiment has shown that the death-rate from tuberculosis in Framingham was reduced from 121 per 100,000 population to 35 or 40 per 100,000 population in the short period of five years. In addition to the many other valuable facts brought out by this experiment it has exerted a splendid educational influence and has already stimulated another great organization, the National Child Health Council, to attempt a similar experiment in child welfare.

As time passed the wisdom of the great national organization became more and more obvious. New tuberculosis associations have continued to spring up all over the country until, at the present time, there exist more

than 1100 such organizations. In 1918 the name of the National Association for the Study and Prevention of Tuberculosis was changed to the National Tuberculosis Association.

During and after the World War the National Tuberculosis Association was found to be of immense value. Many of its members, expert in various phases of tuberculosis, were able to give advice which prevented many deaths from tuberculosis. Indeed, when compared with the armies of other nations the number of our soldiers who developed tuberculosis and had to be returned home at once was very small. Surgeon-General Gorgas and Colonel George E. Bushnell put forth great efforts to exclude the tuberculous from the service. Of our 3,764,101 men examined for the service, there were rejected 176,019 persons who were tuberculous or in such condition as to be in danger of contracting tuberculosis. This was, indeed, preventive work of the highest class.

When the war was over the tuberculous ex-service men presented a huge problem to our government. Although ideal conditions have

not been possible at all times, the United States Public Health Service and the United States Veteran's Bureau have handled the situation admirably. In all this work mutual co-operation has been enjoyed by the National Tuberculosis Association and the government organizations.

From its birth, with Dr. Trudeau as president, the National Tuberculosis Association has had a most unusual group of presidents, nearly all of whom enjoy an international reputation in tuberculosis. At present the association has the honor of having as its chief executive no less an authority on tuberculosis and on world health problems in general than Dr. Livingston Farrand. Dr. Farrand was the first Executive Secretary of the National Tuberculosis Association and he served in this capacity from 1905 to 1914, when he was made president of the University of Colorado. In 1917 the Rockefeller Foundation chose Dr. Farrand to head the Commission sent to France to help in an active tuberculosis campaign. So appreciative were the French people of Dr. Farrand's splendid service that the government bestowed upon

him the decoration of an officer of the Legion of Honor. Upon his return from Europe he was made Chairman of the Central Committee of the American Red Cross. Since 1921 Dr. Farrand has been president of one of America's greatest institutions, the University of Cornell.

Thus the National Tuberculosis Association, born in 1904, has grown to unforeseen magnitude in a remarkably short period of time. With its huge and efficient organization, with its many past accomplishments, with its present program and its vision of future developments, it remains the most powerful organization in America for the control of tuberculosis.

Chapter II

THE TUBERCLE BACILLUS AND ITS GEOGRAPHIC DISTRIBUTION

The tubercle bacillus is a rod-shaped organism from 2 to 4 micromillimeters ($\frac{1}{12500}$ to

Fig. 1.—Tubercle bacilli in the sputum of a case of pulmonary tuberculosis. Ziehl-Gabbett stain. Magnified 650 times. (Cornet and Meyer.)

$\frac{1}{6250}$ inch) long and from 0.2 to 0.5 micromillimeters ($\frac{1}{125000}$ to $\frac{1}{50000}$ inch) wide. Fig-

ure 1 shows the rods with rounded extremities. A few are straight, while the remainder are somewhat curved. The rods often appear in small clusters and occasionally one sees two or more of them united together so as to form a thread or chain, or united so as to form an obtuse angle.

The tubercle bacillus is surrounded by a fatty or waxy substance which is insoluble in ether and alcohol. This substance makes it very difficult to stain the tubercle bacillus with the basic analine dyes, but when it is once stained the same waxy substance makes it very difficult to remove the stain even by the use of dilute mineral acids. This property of the tubercle bacillus has led to the term "acid fast," which is applied to all bacilli showing this quality.

In order to see tubercle bacilli in sputum, for example, a very thin smear of sputum is placed on a glass slide. When well dried, carbolfuchsin (a basic analine dye) is applied to the smear for some time. This stains all the material red. Then the excess carbolfuchsin is washed off and a dilute mineral acid (20 per cent. hydrochloric) is placed

on the smear. This removes the red stain from all the material in the smear except the tubercle bacilli which are acid fast. The acid is removed and an aqueous solution of methylene-blue is applied. This stains all the material in the smear blue except the tubercle bacilli, which remain red. Thus we have the red rod-shaped germs on a blue background.

So far as we know the tubercle bacillus does not grow in nature outside of the bodies of men and certain animals. However, it may be grown artificially on certain culture-media, such as blood-serum, glycerin-agar, etc. On these media the tubercle bacillus grows best at temperatures ranging between 30° and 40° C. The temperature best suited to its growth is that of the body of the animal in which it thrives best.

The tubercle bacillus is killed when exposed to moist heat at a temperature of 100° C., or to a two to three per cent. solution of carbolic acid for a few minutes. It is killed also when exposed to dry heat at 100° C. for an hour. It can resist direct sunlight only a few hours.

The tubercle bacillus may live for a long time in the excreta of tuberculous people

or animals; in fact, it has been found alive in moist sputum more than two months after it had been expectorated and in dried sputum it has been found alive and virulent six months after it was discharged from the patient.

It has been shown that there are different types of tubercle bacillus, such as the human type, the bovine type, the avian type, and the fish or cold-blooded animal type.

The *human type* of tubercle bacillus, as the name indicates, is found primarily in the human species. However, this same type of bacillus has been proved capable of producing disease in such animals as cattle, guinea-pigs, and hogs. The human type of tubercle bacillus is responsible for nearly all of the cases of pulmonary tuberculosis in the human family.

The *bovine type* of tubercle bacillus, as the name indicates, occurs primarily in cattle; although this type of bacillus is capable of infecting many other animals, such as rabbits, horses, goats, monkeys, etc. The most dangerous fact about the bovine type is that it is capable of producing disease in man; indeed, approximately 95 per cent. of the cases of lymph-node tuberculosis, occurring in children

before the fifth year of life, are said to be due to the bovine type of bacillus.

The *avian type* is the primary cause of tuberculosis in birds. The birds most commonly infected are: pigeons, pea fowls, barnyard hens, guinea-fowls, English sparrows, turkeys, canaries, and parrots. It occurs less commonly in such birds as crows, eagles, ostriches, and ducks. The avian type has been found capable of producing tuberculosis in such mammals as mice, rabbits, rats, hogs, monkeys, horses, and cattle. A few authentic cases are on record showing that the avian type has produced definite disease in man.

The *fish type*, or the acid-fast bacillus of cold-blooded animals, has been found in such animals as fishes, frogs, toads, turtles, lizards, non-poisonous snakes, and vipers. That this type of bacillus is capable of producing disease in the warm-blooded animals has not been established.

All of the types of tubercle bacillus have one and the same appearance under the microscope. On artificial media one may be able to distinguish each type by the degree of luxuriance in its growth. The effects produced when

each is inoculated into certain animals aid, also, in determining its type. For example, the human type inoculated in proper dose into rabbits never kills the animals within sixty days and in many instances produces no disease; but if the same dose of the bovine type is inoculated into rabbits the animals usually develop a rapidly fatal form of disease which kills in from thirty to sixty days. The avian type inoculated into the guinea-pig may cause little or no disturbance, but when inoculated into the barnyard fowl it produces very definite disease.

The tubercle bacillus has become very widely distributed over the world. It is especially common among civilized peoples and apparently those most markedly affected are Europeans. This is not surprising when one considers the density of population in many parts, resulting in close living quarters and intimate personal contacts. Again, it is not surprising to find that the mortality from tuberculosis in Asia closely approaches that of Europe when one remembers that its ancient civilizations have produced in many places populations exceeding in density even that of Europe.

From these oriental countries tuberculosis is found to have followed in the wake of emigration. This is easily understood now, since we know that for the spread of tuberculosis it is not necessary that an individual be suffering from active and progressive disease. Many persons who have a latent infection and possess some degree of immunity, while appearing healthy and free from any symptoms of disease, are capable of eliminating through the intestinal tract large numbers of virulent tubercle bacilli. In Africa it is known that the natives were free from tuberculosis for a long period, but as Europeans and Arabs penetrated into the country, as traders and conquerors, tuberculosis followed their trail among the natives. The evidence goes to show, in fact, that the disease is most prevalent along the coasts and that the further one goes into the interior, far less frequented by foreigners, the less commonly does tuberculous infection occur, until finally one reaches certain parts of Africa where the disease is still unknown among the natives. The same thing is true of Oceanica, where in Australia tuberculosis has become quite common, particularly in the cities;

yet in certain of the islands, where there has been very little contact between Europeans or Asiatics and the natives, the disease is rare.

With the appearance of European colonists in South America we find tuberculosis developing among the natives and to such an extent that in certain parts this disease now decimates the native population, while in some of the larger cities the death-rate from tuberculosis has become greater than in the great European cities.

In the United States approximately 100,000 deaths from tuberculosis occur annually and it is believed that there are at all times in the neighborhood of 1,000,000 active cases of tuberculosis in this country. Before the days of European immigration tuberculosis did not exist among the North American Indians, but today the disease threatens to annihilate the Indian race. Similarly, the negroes of North America suffer a much higher mortality from tuberculosis than their European associates (Fig. 2). In fact, its mortality among American negroes has increased very decidedly since the abolition of slavery. In Vienna more than

90 per cent. of the children become infected by the time they reach the twelfth year of life. In St. Louis 65 per cent. of all children under twelve years of age are said to have been infected. Dr. David A. Stewart says: "Even in the western Canadian prairie Province of Saskatchewan a particularly good sur-

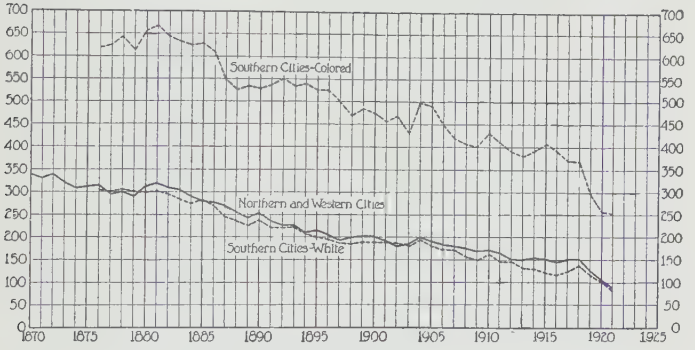

Fig. 2.—Mortality from tuberculosis of the lungs among white and colored races of American cities from 1870 to 1921. (From data furnished by the Prudential Insurance Company of America.)

vey made last year, covering 1 per cent. of the children of the province, showed 44 per cent. infected at six and 61 per cent. at sixteen years. Of 226 young adults, in training as teachers, 76 per cent., by reacting to tuberculin, showed latent tuberculosis. Six per cent. of the young adults had a history of pleurisy and, of all examined, the children and the

young adults, about one per cent. were found to have disease that could be called active." Results have been obtained in many parts of the world which prove that tuberculosis is so wide-spread that in civilized countries few adults escape infection.

What is true of human tuberculosis is true, for the most part, of bovine tuberculosis. Outside the human family, cattle and swine of all animals are the most frequently infected. The tuberculin test has proved that in some parts of the country from 1 to 50 per cent. of the cattle and in some herds as high as 90 per cent. are infected. The disease is most prevalent among cattle which are kept stabled for a long period of time.

It is a well-known fact that in certain countries tuberculosis among native herds has existed only recently, when animals from contaminated herds of other countries have been introduced for cross-breeding purposes. In some sections 25 per cent. of the hogs and in an occasional drove up to 100 per cent. are tuberculous.

Thus tuberculosis has spread to nearly all the known inhabited parts of the world, affecting

especially the human family and one of its most important sources of food-supply in the cattle herds and swine droves. Indeed, it matters not whether man lives in the frigid, torrid, or temperate zone, whether he lives on the mountain top or below sea level, whether he lives in the city or the country, in a humid climate or on the arid lands in much sunshine, everywhere he may be the victim of tuberculosis if tubercle bacilli are carried to him.

Chapter III

METHODS BY WHICH THE TUBERCLE BACILLUS GAINS ENTRANCE TO THE BODY; ITS EFFECTS UPON THE BODY

Since tubercle bacilli do not grow in nature outside the bodies of man and of certain warm-blooded animals, it is obvious that they are transmitted to healthy individuals, directly or indirectly, from infected persons or animals. Tuberculous individuals are capable of voiding from their bodies myriads of tubercle bacilli through the sputum, feces and, in some cases, the urine. Inasmuch as tubercle bacilli may live for months in these moist or even dried excreta, one can readily understand how easy it is for them to find their way into the bodies of healthy persons. For example, sputum expectorated by a tuberculous patient upon the street or ground may be the object of investigation by inquisitive small children who actually touch it with their fingers and soon after unconsciously have the same fingers about

their eyes or noses or even in their mouths. Again, sputum may be carried on the soles of one's shoes to the floors and rugs of dwelling houses where small children playing about come in direct contact with it. Then there are flies and other insects which fly or crawl directly from germ-laden sputum to the food in our stores and on our tables. Sputum may become so dried and pulverized as to be blown about with the dust which often contaminates the air we breathe. In such dried sputum tubercle bacilli may remain alive and virulent for six months. What has been said of sputum applies to such other excreta as the feces from tuberculous individuals.

It has been demonstrated that droplets of saliva ejected from the mouth of a tuberculous patient during coughing, sneezing, or even ordinary conversation may be laden with tubercle bacilli. In coughing or sneezing these droplets may be ejected with such force as to be carried a distance of ten feet and it is believed that the very fine invisible droplets are capable of floating about in the slowly moving air currents of rooms for a long time. With conversation the droplets are ejected with such

force as to be carried a distance of approximately two and one-half feet. It is obvious that healthy individuals, within such range of a patient coughing, sneezing, or talking with the mouth uncovered, are almost compelled to inhale some of the fine droplets of saliva from the patient's mouth.

The bovine type of tubercle bacillus is capable of producing tuberculosis in the human, particularly of the lymph-nodes and bones. It rarely causes pulmonary tuberculosis in man. Large numbers of cattle and swine are infected with tuberculosis and the meat and other food products obtained from them may be teeming with tubercle bacilli. Tuberculosis caused by the bovine type of bacillus occurs more frequently in childhood than during any other period of human life. This may be due, in part, to the fact that dairy products constitute a greater part of the diet of children than of adults. Raw milk from tuberculous cows may contain myriads of tubercle bacilli which, taken into the bodies of children, are capable of producing tuberculosis of a serious nature. Pork and beef from tuberculous animals may become a source of real danger to consumers.

Portals of Entry to the Human Body.—From the foregoing paragraphs it is clear that tuberculosis usually enters the body either through the *digestive tract* or the *respiratory tract.* Occasionally bacilli enter through abrasions of the *skin* and a few cases on record show that rarely bacilli are transmitted from mother to fetus through the *placenta.*

Gaining a Foothold.—When tubercle bacilli enter the body they may find lodgment in the tissues of certain organs of preference, such as the lungs, tonsils, and intestines. From this point on, the effects of these germs upon the body depend, first, upon the number of bacilli present; second, upon their virulence; third, upon the character of the tissues; fourth, upon the ability of the individual to overcome the invasion. After lodging in the tissues the bacilli begin to multiply, but they may meet with so much resistance upon the part of the body that they are walled off and are never allowed to cause any noticeable damage, the individual being unaware, even, of their presence. Such persons are said to have *tuberculous infection* but no tuberculous disease. On the other hand, the bacilli may meet with

so little resistance that they are allowed to multiply abundantly, to invade the tissues and to produce an ill condition of the infected individual. Such individuals not only have tuberculous infection but also have *tuberculous disease.*

When the bacilli begin to invade the tissues any one or all of the following events may occur: first, they may cause the *death of the tissues;* second, they may stimulate the connective-tissue cells in the vicinity to proliferation; third, they may cause an *emigration* of *white blood-cells* to the vicinity, and these, in turn, may lead to the *formation of exudates.* These events may occur separately or conjointly.

Usually when the tubercle bacilli begin to multiply war is declared and there soon appear in the vicinity large cells known as macrophages which actually ingest some of the tubercle bacilli. Then poisons are liberated from the bacilli which stimulate the proliferation of the connective-tissue cells and the epithelial cells in and around the area involved. Next we see large numbers of white blood-cells leave the neighboring blood-vessels, migrate to and

surround the area of disturbance. During this time the fight is in progress and so much poison is liberated in the center of the involved area as to cause the death (necrosis) of the immediately surrounding tissues. No new blood-vessels are formed and frequently the old vessels become obliterated around the tuberculous process, which has now taken on the appearance of a gray or white mass of tissue and is known as a *tubercle*. It is this distinctive feature of the disease in the formation of such tubercles which led to the name "tuberculosis," first proposed in 1810. As the fight continues the forces of the patient's body may become stronger than the army of tubercle bacilli. If so, the proliferation of connective tissue becomes so great as to form a heavy fibrous wall around the diseased area. In fact, the production of connective tissue may be so extensive as to transform the tubercle into a small hard fibroid nodule. It is obvious that the extensive proliferation of connective tissue is a process of healing. It is known as *fibrosis* and usually denotes a good resistance to tuberculosis on the part of the tissues.

On the other hand, the strength of the army

of tubercle bacilli may remain greater than that of the resisting forces of the body for some time. If so, the tubercle becomes larger and may coalesce with other tubercles to form *conglomerate masses or compound tubercles.* The amount of dead substance in their centers becomes extensive and undergoes changes giving it the appearance of cheese, hence the process is known as *caseation.* This caseous material may find its way into a bronchus and gradually be entirely expectorated, thus leaving a *cavity* in the space it occupied. Again the patient's resistance may, in the meantime, have gained sufficient strength to build a heavy connective-tissue capsule around the entire large mass of tuberculous tissue. In such cases the caseous material may remain encapsulated for years, perhaps for the lifetime of the patient. Cases are on record showing that the fibrous capsule may later be broken down so as to allow the caseous material to escape and spread over the adjacent tissues, thus producing an acute tuberculosis. Such a case is on record in which it is believed the encapsulated caseous mass had existed for forty years before it finally ruptured.

In caseous material lime salts may be deposited in large or small amounts. This process is known as *calcification*. Such calcified masses occasionally find their way into the bronchi and are expectorated as *lung stones*. They are found very frequently at autopsy and since the advent of the *x*-ray may be detected in the bodies of living persons. Within these calcified masses, and many years after their formation, may be found living and virulent tubercle bacilli.

In individuals with very slight or no resistance to an existing tuberculous infection large quantities of exudate will appear in and throughout the neighborhood of the involved area. The exudate consists of serum, fibrin, pus, etc. In such cases of low resistance the disease spreads rapidly, often leading to the death (necrosis) of large areas of tissue in a short time. This form of the disease is often spoken of as an acute tuberculosis. It may be brought under control if the patient can later develop sufficient resistance, but its usual course is to lead to the death of the patient.

Frequently one observes the simultaneous development of tuberculous processes in parts

of the body which, anatomically, are widely separated from each other. Again, with an initial tuberculous process in one part, one may, at a later time, find secondary tuberculous deposits either in closely adjacent or remote parts. It is a known fact that from the first area of tuberculous infection—the primary lesion—bacilli may gain entrance to the blood-stream and become distributed generally throughout the organs of the body. Should they invade and proliferate in the tissues of many such organs, the patients develop a condition known as *general miliary tuberculosis* which is almost invariably fatal. On the other hand, from the primary lesion bacilli may be carried by lymph-vessels to lymph-nodes, where they produce secondary lesions. For example, if the primary lesion is in a tonsil, the secondary lesions may appear in lymph-nodes along the side of the neck; or if the primary lesion occurs in a lung, the secondary lesions may be seen in the bronchial lymph-nodes, either of these events occurring frequently in children. In this respect the lymph-nodes may be likened to coast-guards, since in the majority of cases the tubercle bacilli are retained by them and

in many cases overcome by them. In fact, many of the clinical tuberculosis symptoms from which adults suffer are from secondary and tertiary lesions.

For a long time it was a matter of question whether an individual who has had a primary tuberculous lesion could be reinfected by bacilli from another person. In recent years considerable evidence has been gathered which justifies the belief that many cases of the adult type of pulmonary tuberculosis are due to reinfection from other sources than their own lesions of earlier years. Therefore we must protect the adult as well as the child from unnecessary exposure.

The question why tuberculosis is a slowly developing disease in one person and an acute disease with rapid termination in another is often asked. A partial explanation is to be found in the fact that only a few bacilli may gain entrance to the body of one individual, while an overwhelming mass of bacilli will enter the body of the other. Then the question of the relative virulence of tubercle bacilli has been much considered and the belief is now general that this does not widely vary;

that, in fact, it is quantity rather than quality of tubercle bacilli that determines the difference in the effects of the disease upon people. If a small number of bacilli are received within the body the resisting forces may be so rapidly developed as to prevent much or any damage. With such resistance developed, the same individual may become capable of controlling large numbers of bacilli introduced into the body at subsequent periods, provided they are not introduced at too brief intervals and in too massive doses. Such individuals are said to be tuberculized. If reinfections become too frequent, tuberculized people may develop tuberculous disease, but it is nearly always of a very chronic nature. On the other hand, persons who have reached adult life without coming in contact with tubercle bacilli may have had no opportunity to develop resistance. Therefore, upon sudden exposure to considerable numbers or by frequent exposure to smaller numbers of tubercle bacilli, they develop a type of disease rapidly progressive and fatal in a high percentage of cases. Most of us have seen whole families who have never been in contact with tuberculosis die of acute

tuberculous disease soon after some tuberculized relative or friend has joined the family, while the tuberculized individual who has acted as the carrier has lived on for years in apparently good health.

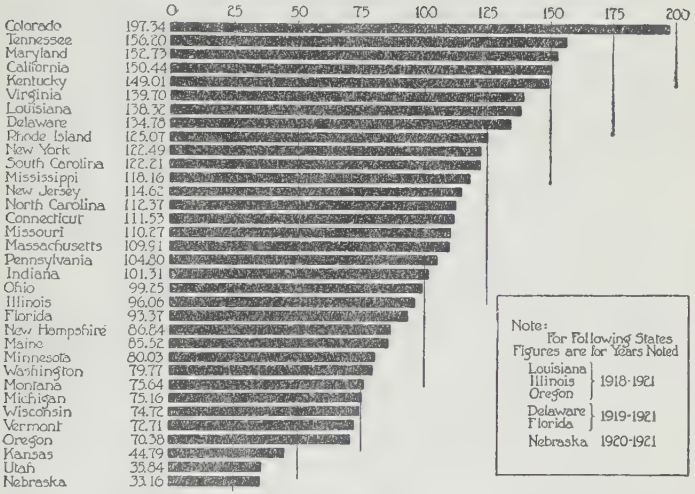

Fig. 3.—Mortality from tuberculosis of the lungs, Registration States, 1917–21. (From data furnished by the Prudential Insurance Company of America.)

In this connection observations upon the susceptibility to tuberculosis of the various races of men have proved very enlightening. In a preceding chapter we have noted that none of them, upon exposure, have escaped tuberculosis, but that the disease is most prevalent

in the densely inhabited parts of the world, while in certain regions still occupied by uncivilized races the disease does not yet exist. Altitude and climate have no effect upon the frequency of the occurrence of tuberculosis, for the disease develops in all races in all inhabited climates and at all inhabited altitudes where the tubercle bacillus is carried. Figure 3 shows the distribution of fatal cases in the United States registration area. However, tuberculosis does not affect all races with the same degree of severity. It is known that a high percentage of Europeans are infected by the time they reach adult life. As a result they have had an opportunity to develop a large measure of resisting power and it follows that only a small percentage of the infected die of tuberculosis. When, however, the European carries tubercle bacilli to the natives of certain parts of Africa, where the disease has never existed, and where, consequently, there is no developed resistance to it, the consequences of infection in these tribes are quite different. Here it acts as a severe, acute, rapidly progressive disease, killing the unresistant natives as poison kills flies.

A very small percentage, indeed, of those infected survive.

What is true of the native African is true also of the North American Indian and of the inhabitants of many of the South Sea Islands. In general, it may be said that these peoples who, living in uncivilized countries or upon remote islands have been protected by their isolation from earlier exposure to tuberculosis, are now found to be highly susceptible to the disease.

The opposite extreme is found in the Jewish race, where tuberculous infection is very common. Yet the mortality from tuberculosis is lower among the Jews than among the Christians in the cities of Europe and America. This is due, perhaps, in great part to the fact that the Jews spend their lives in crowded places and are from infancy exposed to tuberculosis. The mild infections of childhood build up in their bodies a resistance to tuberculosis which unquestionably protects them from fatal disease in later life. In general, it may be said that those people who have lived for centuries in close quarters and who have been exposed to tuberculosis from early ages by close contact

with tuberculous patients have more resistance to tuberculosis than any others. Of the more resistant peoples of the earth the Jews head the list, and then follow the inhabitants of the various European countries, the Chinese, the Americans, etc.

If early tuberculous infection makes an individual more resistant to tuberculosis, the question arises as to why so many persons who have apparently overcome an initial infection will later die of the disease. There are many factors which may at any time reduce one's resistance to tuberculosis, so that an old infection becomes reactive or susceptibility to reinfection is recovered. Of these factors none is more pernicious than alcoholism both in the white and colored races of America. Other mischievous influences are overwork, worry, malnutrition, parturition, lactation, and such acute infectious diseases as influenza, measles, whooping-cough, scarlet fever, pneumonia, etc.

Tuberculosis does not affect people of varying age and sex in precisely the same way. In children the highest death-rate occurs during the first and second years of life. Figure 4,

based upon average statistics of tuberculosis gathered in Prussia during the past sixteen years and upon the researches of the German census among wage earners, shows that after the first year of life the death-rate from tuberculosis gradually decreases until the fifth year. Cornet believes that the high death-rate of the first year of life is due in part to the close association between mother and child, the infection in many cases coming from the mother. However, he does not overlook the fact that in infancy tuberculosis may run an extremely rapid and often fatal course within a few months. After the third year there is a lower death-rate among boys than among girls. Cornet attributes this to the fact that girls remain more closely associated with their mothers than boys. He points out that after the age of five years the boys play upon the streets and otherwise out of doors. Between the tenth and fifteenth years of life nearly twice as many girls die of tuberculosis as boys.

Between the fifteenth and twentieth years of life the mortality from tuberculosis rises rapidly. Moreover, the mortality among boys closely approaches that among girls. This

may be due to the fact that in this period more boys than girls become wage earners and, frequently, in shops and factories. This wage-earning factor becomes more and more

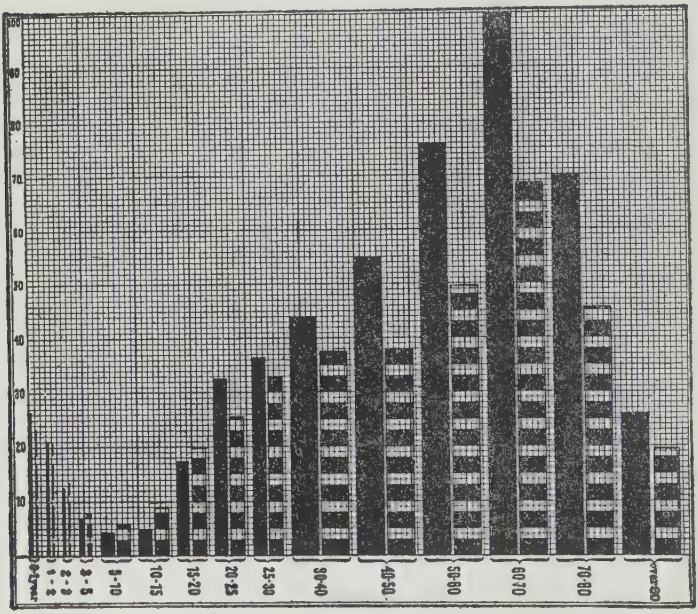

Fig. 4.—Mortality from tuberculosis to each 10,000 of living population at different ages. (After Cornet, "Tuberculosis," W. B. Saunders & Company, 1904.)

important as time goes on. Figure 4 shows that after the twentieth year the mortality among males very definitely exceeds that among females.

Records of mortality from tuberculosis in the United States show the greater numbers

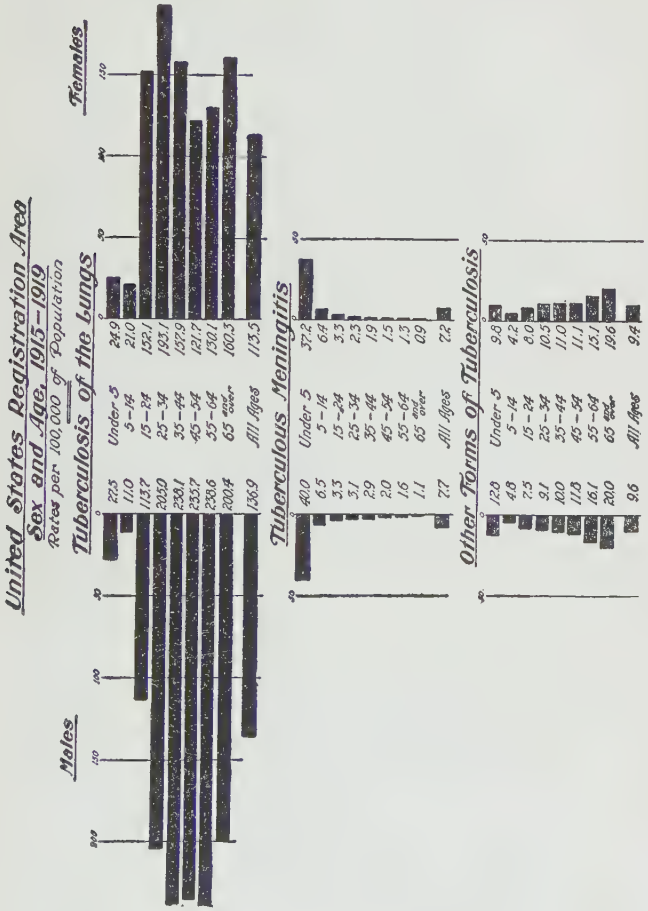

Fig. 5.—Mortality from tuberculosis in the United States registration area, sex and age, 1915–19. (Courtesy Prudential Insurance Company of America.)

of deaths between the ages of twenty-five and sixty years (Fig. 5), while in England and

Wales, after infancy, the highest mortality is between thirty-five and fifty-five years (Fig. 6). The figures are based largely upon hospital records and it is possible that when a more universal report of cases of tuberculosis is

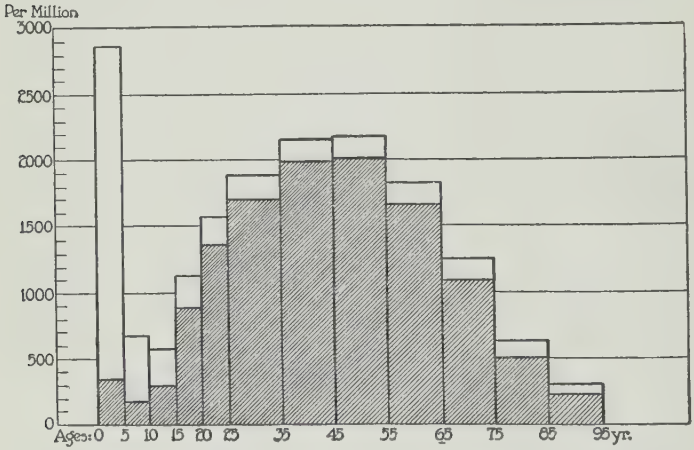

Fig. 6.—The incidence of the mortality from tuberculosis of all kinds and from pulmonary tuberculosis at different periods of life, as shown by the mean annual mortality per 1,000,000 persons living at each age period in England and Wales, during the decade 1901–10. All kinds of tuberculosis. Shaded columns represent pulmonary tuberculosis only. (Slightly modified from Cobbett.)

required of physicians one may find the mortality after the age of forty even higher than it appears to be at present.

The incidence of tuberculosis is greater among city than among country dwellers (Fig. 7). This is due in no small part to social and eco-

nomic conditions. In the country there is no crowding and in most homes there is an abundance of food. The work of the men is, for the most part, done in the open air where there is little danger of infection. Among the very well-to-do classes there is relatively less tuberculosis than among the poorer classes, where

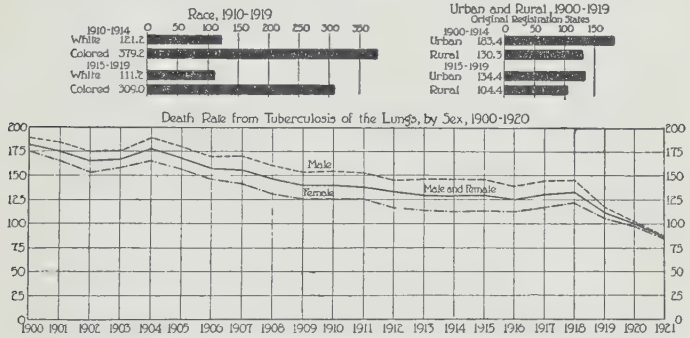

Fig. 7.—Shows mortality from tuberculosis of the lungs among white and colored races, urban and rural dwellers, and in the two sexes. (From data furnished by Prudential Insurance Company of America.)

often there is more crowding and fuller opportunity of contact with tuberculous patients. Moreover, poor economic conditions often lead to malnutrition and this tends to render individuals more susceptible to tuberculous disease. It is a well-known fact that tuberculous persons who have partially or completely lost their earning capacity move into

poorer sections of the cities where cheaper housing comes within their means. In these already overcrowded quarters they become sources of infection to other poor people who are already overworked and have but low resistance to disease.

The clinical course of tuberculous disease has been likened to that of syphilis. The primary lesion of tuberculosis, however, frequently occurs at some time in childhood. It may lead to a rapid termination but more frequently it becomes dormant for an indefinite period of time. Secondary lesions may appear soon after the primary forms. These secondary deposits usually occur in the lymph-nodes, the meninges of the brain and spinal cord, and the bones. These lesions may lead to a fatal termination, as in tuberculous meningitis, or they may become chronic in character and later heal completely, as in cases of lymph-node tuberculosis. Since secondary lesions usually appear in the later periods of childhood, the term "juvenile tuberculosis" has been applied to them. Within or immediately following the period of puberty we find the so-called adult type of tuberculous lesions

(tertiary deposits) occurring in the lung parenchyma, the pleura, the intestines, the kidneys, etc. Sight must not be lost of the fact that the adult type of pulmonary tuberculosis may be due also to reinfection.

Tuberculosis is capable of attacking any organ of the human body. The name of the disease usually implies the organ involved, such as osseous or bone tuberculosis, laryngeal tuberculosis, renal tuberculosis, cervical lymph-node tuberculosis, intestinal tuberculosis, pulmonary tuberculosis, etc. In adult life the lungs are the organs most commonly involved.

Tuberculosis of the lungs may take a slowly progressive course, due to the formation of fibroid tissue almost as rapidly as the disease spreads. This type of disease has been designated *fibroid tuberculosis*. Not infrequently we see persons in advanced life who have this type of disease and whose history indicates that they have suffered from it since early adult or middle life. Laymen often refer to fibroid tuberculosis as the "old-fashioned kind of consumption." The opposite extreme is the acute type, which progresses very rapidly and usually causes the death of the patient within

a few weeks or months after the diagnosis is made. This is known as *acute tuberculosis, quick consumption* or *galloping consumption.*

In cases that terminate fatally we find death may be brought about in either one of several ways. For example, advanced cases may develop tuberculous meningitis and die a meningeal death. Other cases may die suddenly from extensive hemorrhage. The more common mode of death comes through the gradual wasting away of the body tissues as the encroachments of the disease reduce the lung capacity from day to day. Gradually the breath becomes shorter, until finally not enough lung tissue is left to keep the lamp of life burning. After the loss of a daughter from tuberculosis Thomas Hood wrote the following verses which describe beautifully this type of death from tuberculosis.

THE DEATH BED

We watch'd her breathing through the night,
Her breathing soft and low,
As in her breast the wave of life
Kept heaving to and fro.

So silently we seem'd to speak,
So slowly moved about,
As we had lent her half our powers
To eke her living out.

Our very hopes belied our fears,
Our fears our hopes belied—
We thought her dying when she slept
And sleeping when she died.

For when the morn came dim and sad,
And chill with early showers,
Her quiet eyelids closed—she had
Another morn than ours.

Chapter IV

THE DETECTION OF TUBERCULOSIS

To detect tuberculosis in its beginnings and before it has done much damage to the human body is to add years of usefulness and happiness to the lives of the many afflicted with this disease. One who is able to guide people to a realization of the fact that they have tuberculosis before the disease is so far advanced that they may make their own diagnoses deserves to be credited with the saving of lives and the prevention of much suffering. Therefore, every nurse who wishes to be of real service in this field of work should know when to suspect tuberculosis and how to lead its suspected victims to those channels of information through which a final decision as to whether the disease does or does not exist may be reached. She should know, first, the chief symptoms which lead one to suspect tuberculosis and, second, the essentials of a thorough examination in order that those under

her guidance may receive proper investigation of their disease.

There are two chief reasons for the importance of the detection of tuberculosis before it has extended far. First, the life interest

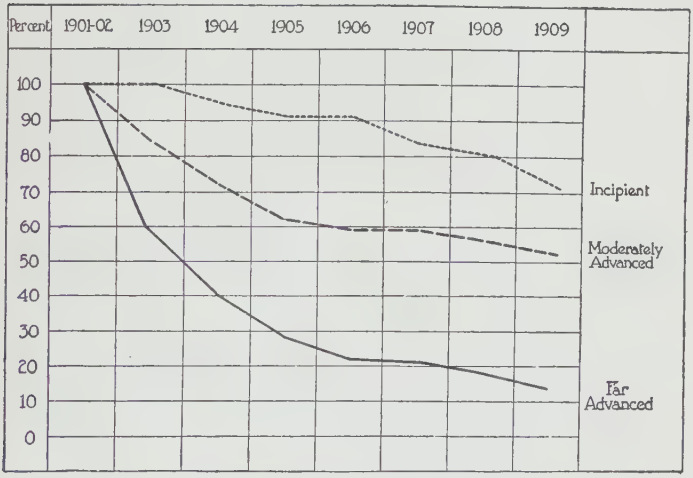

Fig. 8.—Shows the mortality among 111 patients (incipient cases, 25; moderately advanced cases, 43; far advanced cases, 43) discharged from sanatorium during the years 1901 and 1902. (Slightly modified from Bardswell.)

of the patient. Statistics show that the opportunities of complete recovery are much greater when the disease is of slight degree than when it has become advanced (Figs. 8, 9). Second, the interest of the community. It is clear that if a case of disease is allowed

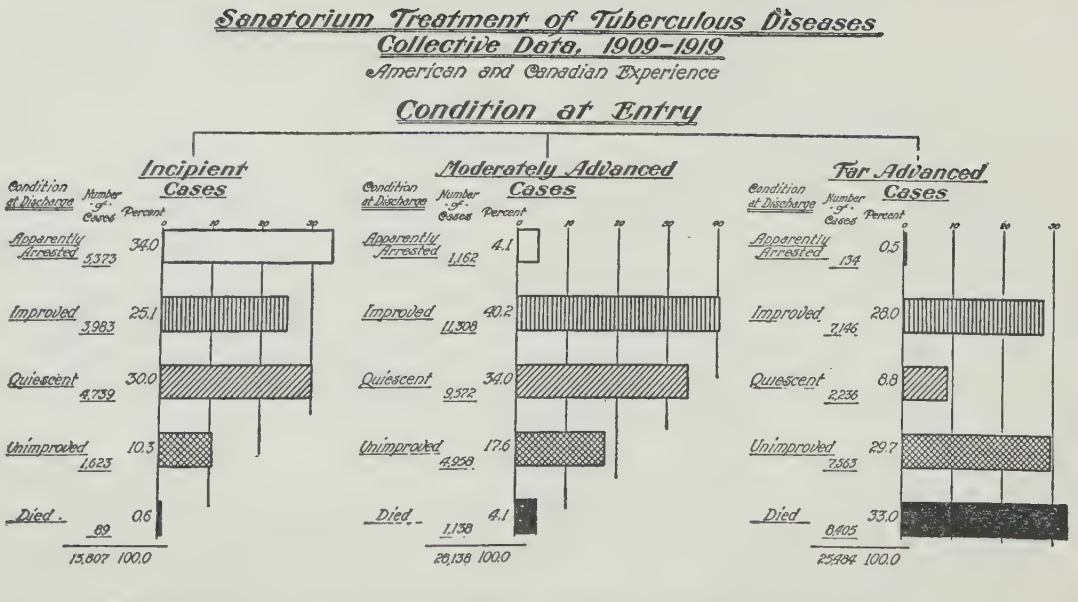

Fig. 9.—General results of sanatorium treatment, regardless of length of stay or method of treatment. It is based on 69,500 cases and strikingly illustrates the necessity of early treatment. (Courtesy Prudential Insurance Company of America.)

to develop to an advanced stage without detection the patient innocently exposes many others to infection.

The symptoms which accompany tuberculosis are many, yet there is not one of these upon which *per se* a diagnosis of tuberculosis can be based; however, there is not one of them but should lead to a suspicion of tuberculosis.

Symptoms

Fever.—A slight *temperature elevation* at some time during the day, and usually in the afternoon, may be a very significant symptom. To be of much real value, however, the temperature must be above 99° F. for men and 99.6° F. for women, and it should be present at some time during nearly every day for more than a week. Although the afternoon, between 3 and 5 o'clock, is the usual time for this temperature elevation to occur, it may be observed at other times. For example, one occasionally sees a patient whose temperature is normal at all times except between 2 and 6 o'clock in the morning, and there are quite a number in whom it rises between 9 and 11 o'clock in the forenoon. Therefore to determine defi-

nitely whether a temperature elevation occurs observations must be made at frequent intervals throughout the twenty-four hours.

The Pulse.—In most cases of tuberculosis the *pulse-rate is accelerated.* Normally there is much individual variation in pulse-rates. For example, an occasional healthy person may be found with a rate as low as 45 to 60 per minute, while another may have a rate as high as 80 to 95 per minute. Moreover, the pulse-rate is increased in many normal people during physical exertion and mental excitement; and, therefore, when the pulse of an excitable person is taken by a strange nurse or strange physician it may run high and yet offer no true indication of disease. The pulse-rate of any individual is best observed always by the same person and with the patient in the same position. To be of significance in tuberculosis the pulse-rate must be persistently above 90 per minute in men and above 96 per minute in women.

Fatigue.—It does not suffice to ask a patient if he tires easily, for we all have that experience too frequently. It is necessary to ascertain whether he had a noticeable loss of strength

dating from a virtually definite date in the past. The individual may complain of a "worn-out" feeling for an hour or so each day before the day's work ends. He may awake tired in the morning. One patient stated that he first felt tired just before leaving work in the afternoon, but as weeks and months passed by this sense of fatigue became so great that he found it necessary to sit down and rest several times during his short walk home each night. When he finally consulted a physician advanced tuberculosis of the lungs was found.

Gastro-intestinal Disturbances. — Not infrequently one of the early if not the first manifestation of tuberculosis is some disturbance of the gastro-intestinal tract. Some of the patients complain of a failing or complete loss of appetite, while others complain of nausea or pain in the abdomen. Although such symptoms do not always accompany tuberculosis, they should at least arouse one's suspicion.

Loss of Weight.—To be of much significance loss of weight must be rather rapid; however, the person who complains of marked and constant underweight must be given careful consideration, but the individual who states

that he has lost 25 pounds in the past two or three years is not to be looked upon with nearly so much suspicion as one who has lost 25 pounds in the past few weeks or months. Rapid weight loss is significant indeed and should always cause one to think about tuberculosis.

Pleurisy.—There are several causes of pleurisy and of these tuberculosis is one of the more prominent. Pleurisies following influenza, pneumonia and other acute respiratory diseases may be of little or no significance; but when a pleurisy appears "out of a clear sky" and particularly if fluid accumulates in the pleural cavity tuberculosis should always be suspected. Many persons complain of pain in the chest who do not have tuberculosis, but one who has an unmistakable attack of pleurisy should have a thorough examination for tuberculosis.

It should not be forgotten, on the other hand, that tuberculosis of the lungs may exist for months and even years without causing any pain in the chest; while, again, chest pains may be an early manifestation of the disease.

Hemorrhage.—The spitting of small streaks or specks of blood may accompany such condi-

tions as bronchitis or may follow a nosebleed. Such blood spitting does not constitute a hemorrhage. If, however, an individual raises a dram or more of bright red blood at one time that individual may be said to have had a pulmonary hemorrhage. Approximately 95 per cent. of such hemorrhages are due to tuberculosis of the lungs. The causes in the remaining 5 per cent. may be ignored until tuberculosis has been ruled out. Unfortunately, attempts are often made to explain the cause of hemorrhage on some other basis than tuberculosis; such, for instance, as bleeding points in the throat; and, in consequence, patients lose their best chance of recovery before the real cause is detected. One patient stated that in the autumn, while carrying bags of potatoes to a cellar, he expectorated approximately a cupful of bright red blood. He was told that the origin of the blood was a bleeding point on one of the tonsils and that he might resume his work in an hour or two. He did continue to work under a false sense of security for six months and during all this time he was gradually declining. When, at the end of this time, he was examined carefully he was found

to have advanced tuberculosis and offered very little hope of recovery. Six months of treatment had been lost and the patient's life materially shortened because the significance of hemorrhage was not understood by those who saw him first.

There is an unfortunate belief prevailing among the laity that bleeding occurs only in the advanced stages of tuberculosis and that following hemorrhage the patient has little or no chance of recovery. The truth of the matter is that hemorrhage may be the first manifestation of the disease. Indeed, the patient who has a hemorrhage in the early stage of the disease is fortunate, for he is easily convinced, even in the absence of pain, that he has a definite disease and is willing to take a sufficiently long period of treatment to heal his lesions. Probably this is the main reason that the incidence of recovery from tuberculosis is slightly higher among those who have a hemorrhagic onset than it is among those who have other types of onset. Always in the presence of hemorrhage one should suspect pulmonary tuberculosis very strongly.

Cough and Expectoration.—Cough accom-

panies several conditions other than tuberculosis. Among them are bronchitis and lung abscess. Most patients who have tuberculosis of the lungs develop cough, but an occasional case may pass through all the stages of the disease, even to death, without cough. Therefore the absence of cough is not definite evidence that tuberculosis of the lungs does not exist. In tuberculous patients the cough may be variably present upon rising in the morning, at bedtime, or at any other time during the day or night. It may be present for a short time each day and entirely absent the remainder of the time.

Cough may be non-productive or productive. With a productive cough the sputum may be small in amount and, in the beginning, of a clear mucous character, but as time passes it may increase materially in quantity and assume the appearance of a yellowish or greenish thick pus. In general, it may be said that a cough, whether productive or non-productive, persisting for more than three or four weeks should arouse one's suspicion sufficiently for insistence upon a determination of the cause.

Frequent Colds.—Persons who are susceptible

to acute infections of the upper respiratory tract may readily pass into a state of low resistance to chronic diseases. After a series of "head colds" they find that a bronchitis follows each attack. There are two possibilities in this: first, that the colds may diminish their resistance to tuberculosis; second, that there may be a tuberculous lesion already existent in the body and in itself causative of a low resistance to colds. Not infrequently the first manifestations of tuberculosis are repeated colds and persisting catarrhal conditions. Such patients are said to have a catarrhal onset.

Night-sweats.—A true night-sweat usually occurs during the later part of the night and always when the patient is asleep. The sweating is so profuse as to require changing of the night clothing and often the bed-clothing must also be changed. With certain individuals who complain of night-sweats one finds that slight sweating occurs soon after retiring and before they fall asleep. Upon investigation it appears that they sleep under too many covers. Such persons do not have true night-sweats and their complaint may be disregarded.

Those in a weakened condition from any cause may have night-sweats. There is a prevalent belief among the laity that night-sweats always accompany tuberculosis. This is not the case, since there are tuberculous individuals who never have night-sweats. Since they do occur, however, in many cases of tuberculosis, particularly in the advanced stages, the patient who complains of true night-sweats should always be carefully examined for this disease.

Exposure.—Persons known to have been exposed to tuberculosis, whether of the human or bovine type, should be kept under observation for a long period of time. Any of the above symptoms appearing in such persons should arouse suspicion immediately. A patient who had enlarged lymph-nodes on one side of the neck gave a history of having taken care of a herd of cattle over a year before. The cattle had been given the proper tests and examinations and more than a dozen of them had been found to have tuberculosis. These tuberculous animals were isolated from the rest of the herd, but the young man was compelled to take care of them. Further ex-

amination of these enlarged lymph-nodes, which had developed on the side of his neck more than a year later, showed that the infection was due to bovine tuberculosis. Other persons will give a history of having taken milk from tuberculous cows at some period in the past; while others state that at some time they have associated and come in very intimate contact with relatives or friends suffering from tuberculosis. By tactful but persistent questioning of childhood exposure, exposure in school or at work may be brought out. Not every one exposed to tuberculosis develops the disease, but, on the other hand, no one develops the disease without exposure. Persons may be exposed unknowingly and, in consequence, a patient who gives no history of exposure to tuberculosis cannot be counted exempt upon history alone.

Upon symptoms alone it is not possible to detect tuberculosis with any high degree of accuracy. The symptoms merely lead one to suspect the disease. Suspects must be examined thoroughly, so that if tuberculosis does not exist some other cause for the symptoms may be sought. The diagnosis of tuberculosis

carries a terrible responsibility. Patients who are given such a diagnosis are stigmatized. For years life insurance companies will not consider them, except when, in a few instances, they are accepted as substandard risks with premiums so high as to make the insurance almost prohibitive. Their relatives and friends are often afraid to associate with them and not infrequently it is difficult for them to secure employment even though they have recovered and are well able to do the work. None but those who have had tuberculosis can really appreciate the stigma that follows in the wake of the disease. And so a diagnosis of tuberculosis should never be given to an individual until a most thorough examination has been made and sufficient evidence has been gathered to fully justify it. Just as great, and possibly an even greater responsibility attends a negative diagnosis; when, in reality, early tuberculosis exists but through carelessness or superficial examination it has been overlooked. In such instances patients are given a false sense of security which too often costs them their lives.

The first phase of an examination consists

in taking a very careful *history* of the patient's past and present complaints. Inquiry is to be made into the details of exposure, time and mode of onset of illness, symptoms, etc.

The *physical examination* constitutes the second phase. Above the waist-line all clothing must be removed from the patient. The physician should inspect, feel, and listen over all parts of the chest in a most careful manner. The temperature, pulse and blood-pressure should be taken and recorded.

At the present day *x-ray plates* are indispensable in many cases. Although the *x*-ray is far from infallible, much information may be gained by its proper use and the proper evaluation of the data obtained from it. A fluoroscopic examination will not suffice; nor is a single plate of much value in questionable cases. Two plates, taken so that they may be placed in the stereoscope, when one sees the shadows in three dimensions, are necessary in all questionable cases.

If a diagnosis cannot be made without them, *biologic tests* should be made. In small children the von Pirquet tuberculin test should always be applied. In adults the subcutaneous tuber-

culin test may prove of value and is harmless if properly done. Although it is too early to draw any conclusions regarding the true value of the Larson ring test, the evidence at hand leads us to believe that it may become a routine procedure in every examination for active tuberculosis.

The most convincing data are often obtained from the *laboratory tests* in which sputum, feces, and other materials, suspected of containing tubercle bacilli, are stained and studied carefully for their presence. If found in sufficient quantities they constitute proof positive of the existence of tuberculosis. If not found so sufficiently present, the fresh suspected material may be inoculated into such laboratory animals as the guinea-pig. If the animals become ill from tuberculosis the evidence is sufficient to justify a diagnosis.

Some cases are so difficult of diagnosis as to require a *period of observation* in bed, where, preferably in a hospital, careful observations of the temperature, pulse, etc., may be made at frequent intervals.

After a diagnosis of tuberculosis has been concluded the patient must be classified. This

is important because some institutions admit only patients in certain stages of the disease. Moreover, the stage of the disease present determines considerable difference in the advice given to the patient concerning the length of the period of treatment that may be necessary. The prognosis, concerning which the relatives always inquire, is determined, in part, by the progress of the disease. Intelligent patients discuss classification a great deal and frequently ask questions about it; and, therefore, the nurse should be able to talk intelligently upon the subject, not necessarily with reference to any individual case, but in order to gain or to retain the greatest confidence of her patients.

The American Sanatorium Association classifies patients with pulmonary tuberculosis, according to the extent of their disease, in minimal (Min.), moderately advanced (M. A.), and far advanced (F. A.) groups. A minimal case may show involvement in one or both lungs, but the total amount of tissue involved must not exceed the equivalent of the lung tissue, of one side, which lies above the second rib in front and the spine of the fourth thoracic

vertebra behind. Likewise, the moderately advanced case may have disease of one or both lungs, but the total involvement, if severe, may extend through not more than the equivalent of one-third the volume of one lung, or there may be small disseminated areas extending throughout one lung. Involvement of a more extensive nature than this places the patient in the far advanced class.

Patients are classified also, according to the symptoms they present, into Groups A, B, and C. A indicates slight or no constitutional symptoms, bearing particularly upon gastric or intestinal disturbance or rapid loss of weight; including slight or no elevation of temperature and no acceleration of pulse at any time during the twenty-four hours. Expectoration must be unusually small in amount or entirely absent. Tubercle bacilli may be present or absent. B indicates moderately active symptoms, such as fever and accelerated pulse, but there should be no marked impairment of function, such as dyspnea, weakness and tachycardia. C indicates severe symptoms, together with marked dyspnea upon exertion, marked weakness, anorexia and tachycardia. Therefore

a patient may be classified as Minimal A, Minimal B, or Minimal C, in accordance with the symptoms he presents. Likewise the moderately advanced and far advanced groups may have A, B, and C symptoms.

After a case of active tuberculosis has so improved as to be without constitutional symptoms, to have physical and *x*-ray findings of a stationary or retrogressive lesion, bacilli being either present or absent in the excreta, and these improved conditions having continued for a period of at least two months, the patient may be classified as quiescent (Fig. 10). If improvement so continues that all constitutional symptoms are absent, that the physical and *x*-ray findings are those of a healed lesion, and that bacilli have been absent from the excreta for a period of three months, the patient is placed in the apparently arrested class. When the same conditions have persisted over a period of six months the disease is said to be arrested. If the patient, under ordinary conditions of life, continues to present the same findings over a period of two years, he may be placed in the apparently cured class.

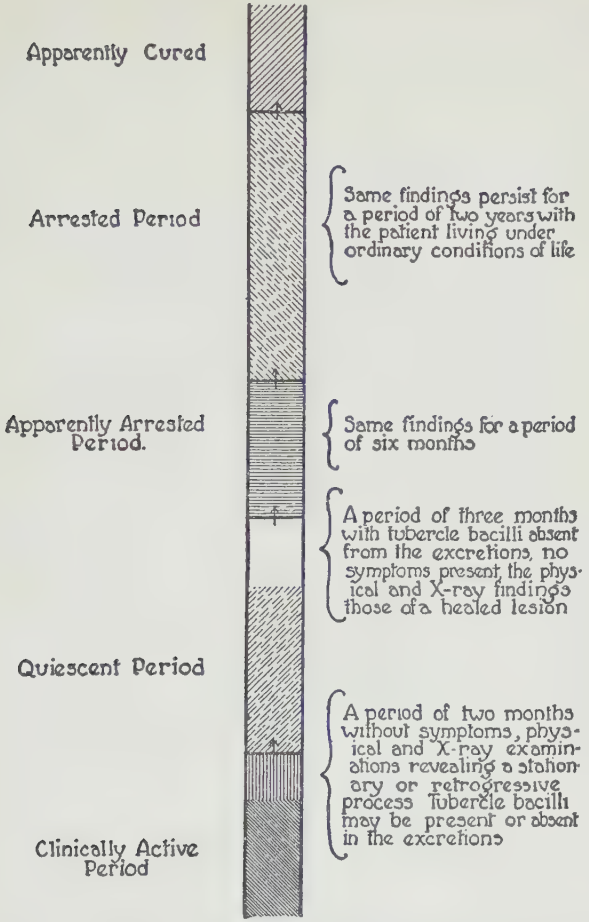
Apparently Cured
Arrested Period
Same findings persist for a period of two years with the patient living under ordinary conditions of life
Apparently Arrested Period.
Same findings for a period of six months
A period of three months with tubercle bacilli absent from the excretions, no symptoms present, the physical and X-ray findings those of a healed lesion
Quiescent Period
A period of two months without symptoms, physical and X-ray examinations revealing a stationary or retrogressive process Tubercle bacilli may be present or absent in the excretions
Clinically Active Period

Fig. 10.—Diagram to show the various stages through which the patient passes from clinically active disease to the apparently cured stage. (After Myers, Minnesota Medicine, August, 1923.)

In the past, medical schools have for the most part given their medical students very

little theoretic or practical training in tuberculosis. Consequently many physicians today manifest so little interest in tuberculosis as to make the work extremely difficult for nurses; however, the nurse who has done her best to discover and carry all of her suspected cases through careful examinations and has prevented them from falling into the hands of those, without responsibility, who employ slip-shod and short-cut methods of diagnosis, will always have a clear conscience and the respect of her patients, inasmuch as "she hath done what she could."

Chapter V

GENERAL METHODS USED IN THE TREATMENT OF TUBERCULOSIS

In the light of modern investigation and observation we have learned that tuberculosis is a disease from which many persons recover spontaneously. It may be said that there is no major disease from which so many people recover without being aware of its existence within them. Moreover, many recover even after severe and prolonged illness from this disease. Not many years ago tuberculosis was regarded as 100 per cent. fatal. He who attempted its cure was laughed to scorn in those days. Now he who fails to put forth every effort to cure the disease must be considered ignorant of recent developments or deserving of malpractice charges.

The present-day method of treating tuberculosis consists of a well-regulated life in which special attention is given to *rest*, *food*, *education*, *fresh air*, and, at the right time, *exercise*. This treatment may be carried out

either in the home or in a sanatorium. The sanatorium is a far better place than the home for the treatment of tuberculosis, but with approximately 1,000,000 tuberculous patients in the United States and only 66,000 sanatorium beds it is obvious that until the sanatorium capacity is materially increased more people must be treated in homes than in sanatoria.

Rest.—Of all the agents ever employed in the treatment of tuberculosis, rest has stood the test of time and is today our most important weapon. Like much of the knowledge we possess, man learned from nature that rest is essential in the treatment of tuberculosis. Nature shows that when certain parts of the body become tuberculous she attempts to immobilize these parts. For example, when a joint is involved she produces an ankylosis (an immobility and consolidation of the joint). When a part of the human lung is tuberculous, nature is observed to throw out little guy-ropes (adhesions) from a near portion of the chest wall in order to partially immobilize the diseased tissue. If the disease continues the adhesions become thick, tough,

fibrous bands which so bind the lung to the chest wall that often it becomes very difficult to remove it even at the autopsy table. Such immobilized parts are frequently seen at autopsy in persons who have died from diseases other than tuberculosis, showing that at some time or other the lung became diseased but was put at partial rest and was healed. In other cases fluid forms in the pleural cavity on the side of a tuberculous lung. The fluid partially compresses the lung, thus allowing it partial rest. All these things nature taught man, and he, through his intellectual powers, devised technical methods of resting a tuberculous organ, such as the cast, artificial pneumothorax, and special chest splints.

When one considers that the normal person breathes more than 25,000 times every day and that considerable movement of the lungs occurs with each breath, one appreciates how difficult it is to heal diseased areas within them. It is a principle of the general rest treatment that we attempt to keep the number of respirations as low as possible, and in so doing to conserve as much bodily energy as possible for nature's fight with the disease.

The length of the period of rest in bed varies with the extent of the disease and the response of the condition to treatment. No patient with active tuberculosis, no matter of how slight a degree, should remain in bed less than six weeks, and in many cases a much longer period of complete rest is necessary to achieve the best results. During this period absolute rest in bed is preferred, although, in some cases, bath-room privileges are permitted. The discontinuance of this absolute rest is decided by a careful study of the patient's symptoms, and particularly of temperature and pulse, and by a careful examination of the diseased areas. The period of rest in bed is broken very gradually, as will be shown in the discussion of exercise. When the patient is able to be up most of the day he still spends at least ten hours in bed each night; two hours in bed each afternoon; and he rests in a reclining chair for one or two hours in the forenoon and for one hour after the evening meal. Such a rest schedule is followed until the progress of the disease is arrested. Then the rest is gradually diminished as the patient is able to increase his exercise. Whenever possible it is

well to adhere to the program of ten hours in bed each night and one or two hours in bed each afternoon for several years. Occasionally ex-patients find their vitality so low that it is necessary to retire immediately after the evening meal and remain in bed until nearly time to begin work the next day. In addition such patients may even be compelled to spend the entire week-end in bed in order to keep up their earning capacity. It is difficult to get patients to remain on a rest schedule sufficiently long. This is particularly true in poor homes. Not infrequently we see patients abandon the rest treatment only to invest in patent medicines or some other method of treatment which falsely promises rapid recovery. Therefore one must guard against such loss of time and expenditure of money on the part of the patient by attempting to make it clear that rest is the most valuable weapon for the tuberculous patient. For all time, after tuberculosis is discovered, the tuberculous patient must make "rest" his watchword. He must never allow himself to become fatigued.

Food.—The food of tuberculous patients must be nourishing, appetizing, sufficient in quan-

tity and of large variety. In many sanatoria a sufficient amount of nourishing food is provided, but the variety is meager. Patients know that on Monday, for instance, they will have the same menu that has been served on every Monday since the institution was dedicated. Again, perfectly good food may be so cooked and served that even healthy working people cannot eat or certainly cannot relish it. Appetite is frequently destroyed in that way. It is certain that unless tuberculous patients are well fed the best results of treatment cannot be expected. It is unfortunate that in some sanatoria the budgets do not provide properly for the kind of food and service tuberculous patients should have, while in homes there may be an insufficient understanding of food values and the necessity of variety.

It is not long since forced feeding was employed in the treatment of tuberculosis. Patients were compelled to eat five or six heavy meals per day. Not infrequently such feeding resulted in serious disturbance of the digestive apparatus, which, in turn, produced a loss of weight and a lowering of resistance to tuber-

culous disease, until the last condition of the feeder was worse than the first. Today forced feeding is not employed. The only approach to it is the allowance, with patients who are underweight, between meals and at bedtime, of a glass of some such liquid food as milk, buttermilk, or egg-nog, which may be so easily digested and assimilated as not to damage the digestive system. Even this extra supply is discontinued as soon as the patient is ten pounds above his initial weight. In general, it may be said that tuberculous patients should receive three meals a day consisting of foods which ordinary healthy people may eat. If there is a sufficient variety and the food is well prepared and well served one need not worry too much about the details of calories or protein requirement, vitamin content, etc. Of course, this does not apply to patients with complications by way of gastric or intestinal disorder, diabetes, or nephritis.

Education.—In the treatment of tuberculosis the education of the patient and his friends regarding the nature, prevention, and control of the disease is very important.

The responsibility of such education rests

largely upon the physician, the nurse, and the public health worker. From the outset the patient must know the seriousness of his condition. It is no time to temporize. The physician who refuses to tell the patient or his friends of the existence of tuberculous disease, in order to spare their feelings, is committing an unpardonable offense. Not infrequently the uninformed patient will pass into a hopeless condition, when he might have been saved had he been advised of the seriousness of his disease and had he been placed on a strict antituberculosis regimen.

In the pedagogic field it is a well-known principle that true education in any subject can be given only to those who are personally interested. It is a principle that may well be borne in mind in the fight against tuberculosis, for there is no group of people so easily approached, so retentive of the teaching they receive and so inclined eventually to become ardent workers in the crusade against disease as are tuberculous patients and their friends. The patient himself is anxious to regain health and, possessed of good judgment, he is always in a receptive mood as to the treatment of his

case. He is anxious, also, to protect his family and friends and may be taught, therefore, in a short time to dispose hygienically of his sputum and other excreta and to avert thereby the spread of the disease. The patient's friends, too, are very hungry for knowledge concerning the cure of tuberculosis. The instinct of self-preservation stimulates their investigation of the ways and means by which they may protect themselves from infection. The receptivity of patients and their friends should always be held in the mind of physicians, nurses, and public health workers; they should neglect no opportunity to teach the truth wherever a case of tuberculosis exists. It is a good time to teach the patient that the restoration of his health depends not only upon the work of the physician and the nurse but also upon his own self-control and courage. He must be taught the need of restraint throughout the period of convalescence.

The education of the public at large depends upon properly trained physicians, nurses, public health workers, and persons who are or have been patients. This work must be carried on largely by public lectures, pictures, and

printed matter issued through the public press and in the form of journals, books, and pamphlets.

The public lecture upon tuberculosis is not always a great success, since it is very difficult in many localities to arouse sufficient interest in public health problems to draw even a small audience. Again, when a large audience is obtained there will surely be many in attendance who cannot be interested in tuberculosis. These obstacles to education are discouraging, but one must always realize that every time the seeds of knowledge are sown a few, at least, will fall upon fertile soil and yield their harvest an hundredfold. It is not alone the physician, nurse, or public health worker who is qualified to give public lectures, for not infrequently the most effective work in this field is done by the ex-patient who relates his personal experience.

Mental impressions made through the sense of sight are usually more lasting than those coming through other senses; and so there are tremendous possibilities in the motion-picture machine. Films showing how the disease is spread and how it may be prevented,

illustrating modern methods of diagnosis and treatment, as well as the results of treatment, are already in existence but are not being used as extensively as one would like to see them employed. Managers of moving-picture houses have already given much aid and it remains within their power to do an inestimable amount of service toward the education of the public in the future.

The medical section and the special articles in newspapers and magazines are reaching many people and deserve to be encouraged. Journals devoted entirely to the subject of tuberculosis, among them the Journal of The Outdoor Life, are conveying each month to homekeepers in thousands of homes the very latest and most authoritative information. Those interested in tuberculosis can make no better investment than to subscribe to these journals.

The National Tuberculosis Association always has many pamphlets containing the most reliable facts and to be had for the asking. This organization also stands ready at all times to secure and furnish any obtainable information to those who may desire it.

Excellent books on the subject, by such authors as E. L. Trudeau, L. Brown, D. MacDougall King, and T. C. Galbreath, all of whom have suffered from tuberculosis, have served to put many an individual on the road to recovery. From the standpoint of the education of patients nurses stand upon the mountain tops because of their intimate and friendly relations with them and their easy access to the homes of the people.

Fresh Air and Climate.—At one time fresh air and climate were regarded as the most important factors in the treatment of tuberculosis. Patients were compelled to stay out of doors all the time and even when weather conditions were most unpleasant and actually jeopardized whatever remaining health they had. Others were advised to flee to mountainous countries where they could live at high altitudes and in abundant sunshine. Today, while we know that fresh air is beneficial we know, too, that it is not necessary to remain out of doors in severe weather in order to get it. A well-ventilated room or a sleeping porch in suitable weather is quite sufficient. Moreover, we know that not all cold air is fresh

air, nor is all fresh air cold. Contrary to former beliefs regarding the effects of air, we know now that in the treatment of tuberculosis the beneficial effects upon the body are due to the stimulating action it has upon the skin and mucous membranes of the upper respiratory tract rather than to the chemical constituents of the air. In fact, the air in which most people live does not vary greatly in its chemical composition. Cool air of the proper humidity has a greater stimulating effect upon tuberculous patients than warm air. Therefore the patient's room should be kept cool, except in the case of the very weak or old, who do not respond well to the stimuli produced by cold air. The air of the rooms of tuberculous patients should be kept in motion. During the winter months there is little difficulty in keeping up ventilation, but in the summertime one may have to resort to fans. In general, it may be said that the qualities by which we now distinguish "good air" from "bad air" are motion, temperature and adequate humidity.

Experience of recent years has changed also the views of specialists in tuberculosis upon

the value of climate in the treatment of the disease. It is not so very long since a change of climate was looked upon by many as a quick cure for consumption, and when patients, even in advanced stages, were often told that if they would seek a high altitude, in a section of the country where the sun shines abundantly, within a few weeks after their arrival they would be able to do light work and to support thereby themselves and their families. Those who gave this advice really thought they were doing the best thing possible, but they did not have the opportunity to see many of these patients in their new surroundings—discouraged, homesick, unable to work, at heavy expense, and in gradual decline. The influx of patients to health resorts, in climates considered good for the tuberculous, has been so great that physicians located in these regions, particularly in the Southwest, recently asked the National Tuberculosis Association to inform the medical profession as to the class of patients that could hope for benefit by a change of climate. In the first place, they pointed out that the patient must be financially able to spend at least $1000 a

year in order to have the mere necessities of life. Doubtless the advanced cases which give little hope of recovery were not desired in any climate.

It is stated by many writers that certain climates offer from 10 to 15 per cent. of advantage to the tuberculous patient. No one can question the fact that a patient may be a great deal more comfortable out of doors during the winter months in the States of the southwest than in the northern States. Furthermore, those patients who are very susceptible to "ordinary colds" and bronchitis will often find their attacks less frequent in milder regions. The higher altitude and the decreased humidity may play some part. It should be thoroughly understood by both patient and physician that the visiting sick must be placed upon no less strict a rest regimen than they were on in their home climate. The sanatorium treatment throughout the United States is pretty much the same everywhere, the emphasis being usually placed on rest, abundant food and fresh air, in the order given. Change of climate is well discussed in a little book entitled "T. B., or Playing the Lone Game

Consumption," in which the author, Thomas Crawford Galbreath, gives his personal experience and observations while "taking the cure" in different climates.

After all, the question of climate is one which cannot be answered for tuberculous patients in general, but must be dealt with in each individual case with due reference to the patient's temperament, his ability to pay, and the stage of his disease.

Dr. Flinn, after making a considerable study of climate, as of other factors entering into the treatment of tuberculosis, sums up the present situation in the following paragraph:

"As between care (that is, fresh air, good food, rest, and competent medical attention) and climate, the latter must always continue to be a secondary consideration. In the least favorable climate good care, provided the surroundings be the best obtainable, will produce much better results than the best known climate without care. If the patient must choose between the two, he should take the care and let the climate go; but if he be so fortunate as to be able to have them both, his prospects of recovery are certainly brighter than

they could be if he were compelled to depend on one alone."

Exercise.—There comes a time in the tuberculous patient's period of convalescence when exercise is indicated and must be initiated in order to restore his working capacity. Exercise has been likened to a two-edged sword. It is a very valuable weapon in certain stages of the disease, when prescribed by one who knows its uses; but, on the other hand, many tuberculous patients have been exercised to untimely deaths. When the patient is able to discontinue absolute rest in bed, exercise should be initiated in a most cautious manner. For example, the patient may be allowed only to dress on the first day; he is then permitted to go to the table for one meal a day provided the dining room is on the same floor. If no symptoms appear within a week or two the patient is allowed to be up for two meals a day. A little later the patient is permitted to take exercise in the form of walks. On the first day thereafter, at about ten o'clock in the morning, he walks slowly from the house for two and a half minutes, by the watch, and then turns and walks slowly back to the house.

This five minutes of exercise is taken every morning for a week, and, if no symptoms of disease activity occur, a similar walk for five minutes is permitted in the afternoon at about four o'clock. This exercise is very gradually increased until the patient is walking three or four hours a day. Light work may then be undertaken for an hour or so at a time, and the time may be gradually increased until the patient acquires a reasonably good working capacity.

The exercise prescribed in the beginning is so slight as to seem foolish to many patients, but they must ever be impressed with the fact that they are suffering from a relapsing disease and that too much exercise may be productive of a relapse. They must come to realize at all times that the first sense of fatigue is their danger singal.

Chapter VI

SPECIAL METHODS USED IN THE TREATMENT OF TUBERCULOSIS

We have seen that nature attempts to place at rest a part of the body which has become tuberculous. There is an attempt, for example, to immobilize the tuberculous lung by making it adherent to the chest wall. Again, nature often produces fluid between the lung and the chest wall which partially compresses the lung and serves as a splint. Obviously, when the lung is so compressed its degree of expansion with each respiration is diminished, less air passes into it, and the diseased parts of the lung have a better opportunity to heal. Man has learned to assist nature in many of these cases by the development of special methods of producing rest in a diseased part; among these are the provision for postural rest, the use of chest splints, and the collapse of the lung by surgical methods.

Postural Rest.—This method of treatment was described by Webb, Forster and Gilbert, of

Colorado Springs, who reported excellent results in more than 200 cases. The only failures in improving the health of the patients they met with were in cases too far advanced in disease of both lungs or in patients who failed to carry out the treatment faithfully. This method is now in use quite extensively in many parts of the country.

The patient is instructed first to lie on the side of the more diseased lung for a few minutes each day; then the time is gradually increased until the patient lies on this side for at least twenty hours every day. A small hard pillow is usually placed under the ribs. It has been shown that the lung on the side upon which the patient lies undergoes less movement than the opposite lung during respiration and that its aëration is greatly decreased. The heart becomes displaced toward the recumbent side, the ribs are brought closer together, and the abdominal viscera push the diaphragm upward on this side. The result is a marked diminution of the lung volume. It is obvious that under such conditions the recumbent lung is used much less than the opposite one.

Under this treatment it often requires but a

few weeks to bring about the subsidence of fever, decrease in pulse-rate, loss of cough, greatly diminished expectoration and decrease of râles. Ordinary pulmonary hemorrhages also respond nicely to postural rest. Webb reports a case in which there had been extensive disease of the left lung with a series of hemorrhages eighteen years before. At that time the patient was given postural rest and, at the present time, this patient is working as a stenographer.

Chest Splints.—In recent years splints have been devised which are applied to the outside of the chest over a diseased lung in an attempt to partially immobilize the lung, thus giving it more opportunity to rest. In certain cases such splints have been found to be of considerable value. They should be used only when prescribed by the physician.

Artificial Pneumothorax.—In nature's process it has been observed that in a diseased lung it is not uncommon for a spontaneous rupture to occur, allowing air to escape into the pleural cavity. If parts of the lung have not already been bound down by adhesions a complete collapse of the lung usually follows such a

rupture. When such a collapse occurs the lung is thrown into disuse. There are no expansions in breathing and the lung is absolutely at rest. Under such local rest healing may take place quite rapidly if the opposite lung is not involved and is able to carry the burden of both lungs. As early as 1832 Dr. J. Houghton reported a case of advanced tuberculosis in which a spontaneous rupture of the lung occurred, after which the patient worked twelve hours daily laying bricks in the building of a chapel. Other similar cases have been reported.

Since spontaneous collapse of a lung may prove so effective in some cases, why should not the same results be obtained by artificial collapse? Dr. A. K. Krause has pointed out that in the time before Christ the Greeks were asking the same question and actually attempted collapse of the lung in a crude manner. The subject of artificial collapse of the lung was dwelt upon at some length by J. Carson, in 1821, and again by Stokes in 1837. The idea was apparently dismissed until 1880, 1882 and 1884, when Toussaint, Forlanini, and Potain respectively reopened the discus-

sion. Cayley in 1885 actually attempted to collapse the lung of a patient suffering from pulmonary hemorrhages. While his method consisted merely in making an incision in the chest wall, thus allowing the outside air to rush into the pleural cavity in an attempt to collapse the lung, he partially accomplished the desired result, and the hemorrhages were pretty well controlled in spite of the fact that strong adhesions prevented a complete collapse. Murphy (1898), Schell (1899), and Lemke (1901) applied the collapse treatment in cases of pulmonary tuberculosis with very good results. Since then this procedure has slowly but surely become more and more popular, until today it is being employed in all countries with remarkable results.

The cases most suitable for artificial collapse are those in which the disease is limited to one side. Good results, however, are obtained when the involvement includes one whole lung and the upper lobe of the opposite side. If the upper lobe of the other lung is involved it is best, if at all possible, to make fairly certain that the disease is inactive in that lobe before proceeding with the operation.

Unfortunately, but a very small percentage of patients applying for treatment are suitable for the artificial collapse operation. Often the disease has been allowed to progress so far that the better lung is unable to carry on the function of both lungs in the event that the more diseased one is collapsed. Again, in a considerable number of cases, so firm adhesions have formed that a complete compression of the diseased lung is impossible. It would seem, however, that most patients must, at some time, pass through the stage when artificial pneumothorax is possible. It becomes, therefore, a question of securing the patient in the early stages of the disease and of carefully observing his progress from time to time in order to make sure that it does not advance into either one of the conditions by which an artificial pneumothorax is contraindicated. It is not to be understood, however, that artificial pneumothorax is indicated in every case of tuberculosis. It is only after a patient has failed to respond to the rest treatment or is unable or unwilling to take the rest treatment that one should resort to artificial pneumothorax.

In far-advanced tuberculosis of one lung the artificial collapse offers tremendous hope. We frequently see patients who have given up all hope respond to the compression operation in a manner that is little less than miraculous. Patients who have been bedridden for weeks and months sometimes lose all symptoms and regain a fair working capacity. The famous Dr. E. L. Trudeau, the pioneer in the successful fight against tuberculosis in this country, after having suffered at intervals for nearly forty years from pulmonary tuberculosis, was entirely relieved of symptoms from the date of the collapse of his diseased lung, two years before his death, resulting from other causes, at the age of sixty-seven years.

In some cases of hemorrhage which absolutely refuse to yield to any other form of treatment artificial pneumothorax is a God-send. One occasionally sees cases so exsanguinated from pulmonary hemorrhage that all hope has vanished from the minds of patients and friends alike, in which, as a last resort, artificial pneumothorax may arrest bleeding and restore the victim to reasonably good health.

For the pneumothorax operation the patient

is placed on an operating-table. A pillow is placed under the side of the better lung upon which the patient lies. This tends to spread apart the ribs over the side of the diseased lung. The physician then determines the site over which the needle is to be introduced. The area around this site receives an application of iodin, which, later, is partially removed by alcohol. The tissues under the selected site are infiltrated with a two per cent. novocain solution. When the anesthesia is sufficiently complete a larger needle connected to a water manometer is introduced into the pleural cavity. When the pleural cavity is reached the negative pressure draws the water in the manometer toward the side to which the rubber tubing is attached (Fig. 11). One is able then to observe definite oscillations in the water column indicating the changes in the pressure within the pleural cavity occurring with each respiration.

When one is sure that the tip of the needle is within the pleural cavity the stop-cock is turned and a few cubic centimeters of gas (oxygen, nitrogen, or sterilized air) are allowed to flow into the pleural cavity. The gas is

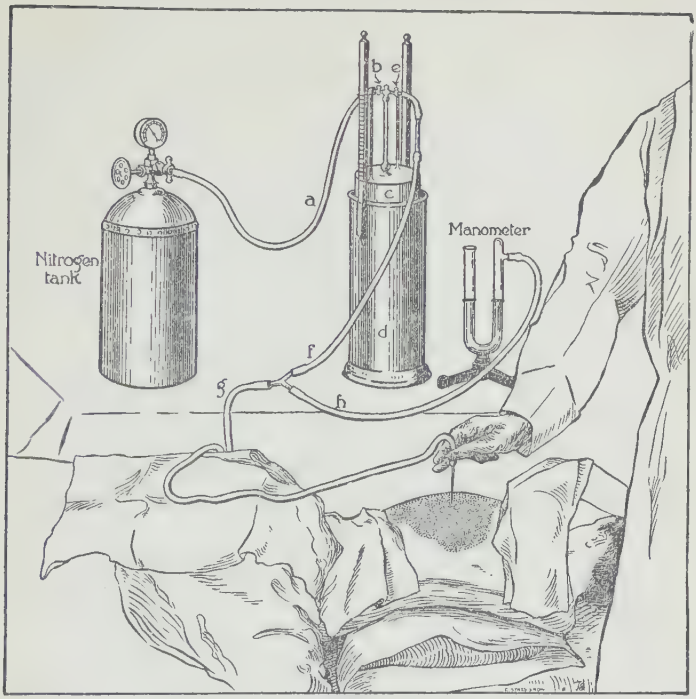

Fig. 11.—Artificial pneumothorax apparatus. Nitrogen from the tank is allowed to flow through tube *a* and valve *b* into cylinder *c*, which is open below. Cylinders *c* and *d* contain water; therefore the nitrogen accumulates in *c*, displaces the water under pressure, and elevates the cylinder. When *c* contains a sufficient amount of nitrogen the valve *b* is closed. The valve *e* remains closed. The needle then inserted into the pleural cavity is connected through tubes *g* and *h* with the manometer, which registers the pressure in the pleural cavity. If the pressure reading is satisfactory, the valve *e* is opened and the nitrogen from cylinder *c* flows through tubes *f* and *g* into the pleural cavity.

then turned off and the manometer readings are recorded to be sure that the gas is reaching the pleural cavity. If the oscillations are satis-

factory, more gas is admitted to the pleural cavity. With the first operation the manometer readings are taken with every 50 c.c. of gas injected. Rarely more than a total amount of 150 to 300 c.c. of gas is injected at the time of the first operation. This amount of gas

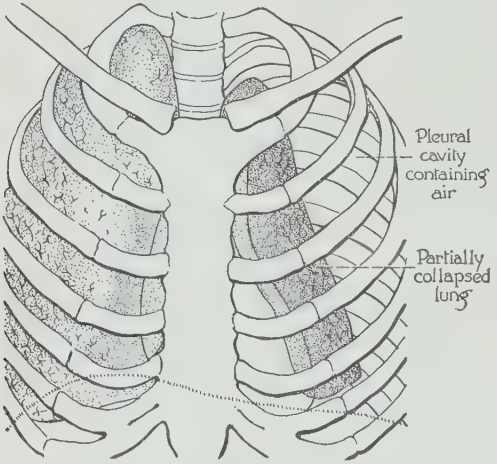

Fig. 12.—Made from an *x*-ray plate showing left lung partially collapsed following artificial pneumothorax treatment.

reduces the negative pressure as indicated on the manometer. Because of the preponderance of elastic tissue in its substance the lung begins to collapse as the negative intrapleural pressure is decreased (Fig. 12). When sufficient gas has been introduced, it is turned off and the needle withdrawn. The site of the

puncture receives an application of iodin, which is washed off with alcohol, and the small wound is sealed with collodion. Two or three days later more gas is introduced into the pleural cavity. The amount of gas admitted depends upon the manometer readings. One should stop while the pressure is slightly negative. Four or five days later enough gas is introduced to bring the manometer reading to the zero mark. This indicates that the pressure in the pleural cavity is the same as the outside atmospheric pressure, which also is about the same as the pressure within the lung itself. It is obvious, since there is so much elastic tissue within the lung, that a collapse will occur when the pressure without is the same as that within the lung. This is exactly what happens; the lung is not used in respiration and, therefore, it is placed at almost absolute rest. Rarely do we make the pressure in the pleural cavity greater than atmospheric pressure and only when it may be necessary to effect a more complete collapse.

The gas in the pleural cavity is gradually absorbed, hence it must be replaced at certain intervals. The periods between these refills

depend upon the rate of absorption, which in the course of time is subject to a great deal of individual variation. In some persons refills are necessary every seven to ten days. In others every two weeks is often enough. The intervals between refills may be lengthened after the patient has taken gas over a long period of time, as absorption then takes place less rapidly. The interval may be lengthened to three or four weeks and a few cases are on record which show that even longer intervals are sometimes possible.

Artificial pneumothorax must not be looked upon as a "cure all." It is merely an aid and should always be carried out in conjunction with such a strict hygienic and dietetic regimen as we have described under the General Methods Used in the Treatment of Tuberculosis.

There are certain complications which may attend the artificial pneumothorax treatment, such as the accumulation of fluid in the pleural cavity. If the fluid is small in amount and causes the patient no symptoms, it is left undisturbed, otherwise it is removed by aspiration. Occasionally the fluid may become contaminated, thus resulting in the formation of

pus in the pleural cavity. Some such cases have been cleared up by frequent irrigations with Dakin's solution, while in others surgical intervention has been necessary. Two dangers to be considered while introducing gas into a pleural cavity are pleural shock and gas embolism. Pleural shock results from the mechanical stimulation of the pleura, while the embolism is due to air being injected into the blood-stream. Although these conditions may result in the sudden death of the patient they occur very rarely.

The time over which pneumothorax should be continued may vary somewhat in individual cases, but it is generally believed by those most experienced in this work that three to five years should represent the minimum time. At the expiration of the period required for healing the lesion present, the gas in the pleural cavity is allowed to absorb and the lung to expand gradually and resume its functions. When once allowed to expand, adhesions usually develop between the lung and the chest wall, obliterating the pleural cavity so completely as to make artificial pneumothorax impossible ever after. Therefore the refills should

never be discontinued until one feels sure that healing is complete.

The value of artificial pneumothorax in the treatment of pulmonary tuberculosis is expressed by Riviere as follows:

"No more hopeful ray of sunshine has ever come to illumine the dark kingdom of disease than that introduced into the path of the consumptive through the discovery of artificial pneumothorax."

Surgery.—There are cases in whom artificial pneumothorax is indicated, but upon whom it cannot be performed because of the presence of adhesions or other conditions. Fortunately, in some such cases it is possible to collapse the diseased lung by surgical methods. Segments of the upper eleven ribs are removed so that the side of the chest is no longer protected by a bony framework. Because of the negative pressure in the pleural cavity the lung is allowed to collapse under the influence of the outside atmospheric pressure. When the lung and the soft parts of the chest wall have fallen in and the desired collapse is accomplished the ribs are allowed to regenerate around the collapsed lung, thus holding it in its new position

permanently. This procedure must be looked upon as a last resort, and is applicable to but a small group of patients; and yet to them it partially restores health and in some cases restores their earning capacity. Therefore, surgery must not be ignored, but must be looked upon as a distinct aid in the treatment of certain carefully selected cases of pulmonary tuberculosis.

Besides these special procedures, directed primarily toward the rest of the diseased organ, other methods, such as heliotherapy, *x*-ray therapy, and the use of tuberculins have been found very helpful in certain cases.

Heliotherapy.—The ancients had great faith in the healing powers of sunlight, but it was not until the time of Rollier that we had any knowledge of sunlight applied scientifically and on a large scale in the treatment of tuberculosis.

In 1903 Rollier opened at Leysin, Switzerland, a clinic for the treatment of surgical tuberculosis by the general sun-bath. His results were so gratifying that from this small beginning he has extended his work, so that at the present time he finds sun-baths a valuable pre-

ventive measure as well as a valuable influence in maintaining the cure of tuberculosis.

Although the work of Rollier was conducted at a high altitude above the cloud line, it has been shown by many physicians in this coun-

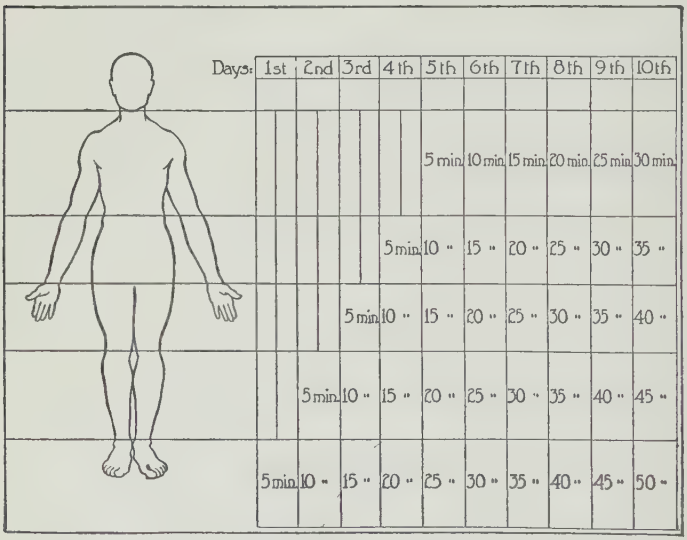

Fig. 13.—Diagram showing how progressive exposure to sun should be carried out. From the tenth to the fifteenth day the same plan is followed. After the fifteenth day complete exposure from the beginning of the sun-bath. (Made from Rollier.)

try that a high altitude is not essential to good results from heliotherapy. The patient is placed in the sun, well protected from the winds, and the exposure is begun very gradually. On the first day only the feet to the

ankles are exposed for three different periods of five minutes (Fig. 13). On the second day the feet are exposed three times for ten minutes; and five minutes' exposure is given three times from the ankles to the knees. On the third day the feet are exposed fifteen minutes, the ankles to the knees ten minutes, and the knees to the hips five minutes at three different times. On the fourth day the exposure of the parts previously exposed is increased five minutes and the abdomen is exposed for five minutes. On the fifth day all exposures are increased by five minutes and the thorax is exposed for five minutes. The exposures each day are given to both the front and the back of the body, and at three different times during the day. From this time on the exposures are increased five minutes a day until the patient is lying in the direct sunlight two or three hours a day. One to one and one-half hours of sunbath are given in the morning and for the same length of time in the afternoon. The eyes and head are always protected from the direct rays of the sun by linen hats and colored lenses.

This technic, which is illustrated in Fig. 13,

is the one usually applied. However, there are individual cases, such as those who are quite weak and those whose skin tends to burn rather than tan, in whom we must proceed with the exposures much more slowly. The temperature of the sun, the time of day, and the season of the year must also be given due consideration.

Occasionally a patient's treatment is unavoidably interrupted for a few days. When the exposures are resumed they are begun several stages below where the patient stopped.

Heliotherapy has been used extensively in tuberculosis of the bones, joints, and lymph-nodes. Rather recently it has become quite popular in the treatment of tuberculous enteritis, otitis media, laryngitis, etc. For a long time members of the medical profession felt that sun treatment was contraindicated in cases of pulmonary tuberculosis. More recent work has shown, however, that such treatment may be given to many pulmonary cases with reasonably good results.

The beneficial effects of sun treatment have been attributed largely to the ultraviolet rays; hence considerable study has recently been

made of these rays. It has been shown that ultraviolet rays are more abundant just after a rain- or snow-storm when the air has been cleared of many of its dust particles; also that they are more abundant and more powerful in summer than in winter and in high rather than in low altitudes. The rays are reflected by water, hence the good results obtained by many in taking sun treatment at the seashore. Ultraviolet rays are also reflected by ice and snow, but, best of all, by nickel and platinum.

Many have tried to take sun treatment in glass rooms, not knowing that ordinary window-glass prevents the penetration of ultraviolet rays.

The chief difficulty in giving sun treatment is that in some parts of the country the sun shines only a small portion of the time. There are days and even weeks at certain seasons when the sun shines very little or not at all. To overcome this difficulty lamps have been constructed which give off many ultraviolet rays. Such lamps have proved to be very effective and a good substitute for the sun treatment (Fig. 14). Hence it is now possible to give sun treatment wherever such lamps can be

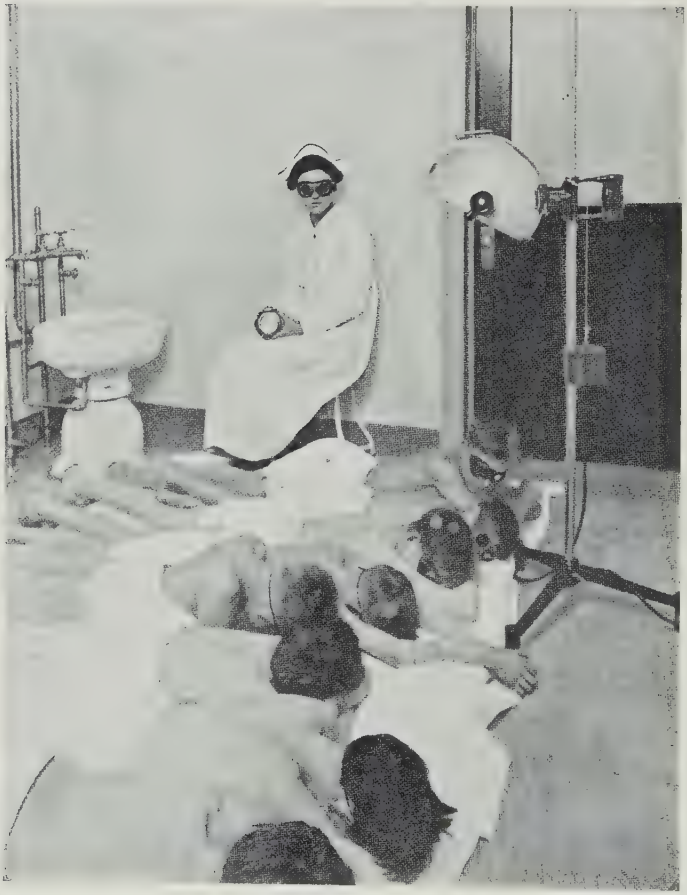

Fig. 14.—A group of children receiving treatment under Alpine sun lamps. (After Myers, Journal of the Outdoor Life, December, 1922, p. 395.)

operated. In giving sun lamp exposures it should be remembered that with the lamp at a

distance of thirty inches from the body one minute of exposure is equal to four or five minutes of natural sunlight exposure.

Heliotherapy is gaining in favor with both patients and physicians and promises to aid in effecting many cures and to avert much suffering in the future.

x-Ray.—At one time it was believed that the *x*-ray would become a powerful factor in the treatment of all forms of tuberculosis. As yet this hope has not been realized. Although the *x*-ray offers an excellent mode of treatment for tuberculosis of the cervical lymph-nodes, it has been found of little or no value in the treatment of the more serious tuberculous processes involving the lungs and intestines. Perhaps further investigation may find for the *x*-ray a place in the treatment of tuberculosis which is not understood today.

Tuberculin.—A few years ago a great wave of enthusiasm spread over the world for the treatment of tuberculosis by the administration of tuberculin. By super-enthusiasts it was claimed that tuberculosis in any stage could be absolutely cured. These same individuals even predicted that within a short time the

words "consumption" and "tuberculosis" would have only a historic interest. Many patients spent large sums of money to secure tuberculin treatment and many relapses and not a few deaths resulted from the careless administration of the remedy.

In spite of the fact that the pendulum swung too far in favor of tuberculin treatment a few years ago and that it has now swung too far in the opposite direction, there is a certain class of patients that seem to do well on tuberculin. Occasionally one sees a patient with a slight fever that refuses to yield to any other method of treatment or a patient whose disease seems at a standstill who does well on tuberculin administered in the proper dosage. In such a case the very small amount of tuberculin given probably causes a slight irritation around the diseased area which is met by a local reaction at that point, thus stimulating the formation of scar tissue which walls off the disease.

While tuberculin is not so powerful as some of the other weapons used in the fight against tuberculosis yet it plays a distinct and important part; and we may hope that new methods

of preparation and administration will render it even more valuable in the future.

Air-bath.—At one time we believed that all the beneficial effects of out-of-door living were derived from breathing the fresh air. Today we know that the chief benefit is in the *air-bath* which the outside of the body receives. In fact, tuberculous patients may be benefited greatly by air-baths, which are given by having the patients remove all clothing and lie on a bed or cot either in a well-ventilated room or out of doors when the temperature is comfortable. The duration of the air-bath should be increased from a few minutes in the beginning to an hour or more each day. For the essential purposes of the air-bath the patient is not placed in the direct rays of the sun.

The *water-bath* may be given with hot, tepid, or cold water, the temperature being governed by the condition of the patient. Hot water is used rarely and only when especially prescribed, since it has a depressing effect upon most patients. The tepid water-bath is used often enough to keep the patient's skin clean and to promote its proper functioning. Cold water is very stimulating; so much so, in fact,

that the cold shower or cold plunge is rarely advisable for patients with active tuberculous lesions of the lungs. Cold water is best used in the form of a sponge-bath, only small parts of the body being exposed and stimulated at a time. Such bathing is invigorating and produces definite beneficial changes, improvement of appetite, etc., in a short time. Some very weak patients do not react well to even the cold sponge and are given only tepid water baths.

Treatment of Hemorrhage.—Not infrequently the nurse is called upon to give first aid to patients bleeding from the lungs.

There is nothing more alarming to the patient and the family than hemorrhage. The blood may vary in amount from a teaspoonful to a loss sufficient to cause the death of the patient. The patient's physician should be summoned at once and, in the meantime, the nurse can do much to stop the bleeding as well as to reassure the family that a hemorrhage that is not immediately fatal can usually be brought under control in a reasonably short time. The bleeding should be brought under control at the earliest possible moment. In

order to do this the patient must not be allowed to undress, but should be immediately placed in a semireclining position with the chest at an angle of 30 to 45 degrees with the plane of the bed. This position is the best because it is the most restful one, in which the patient can expectorate and take necessary food with a minimum of physical exertion. If much blood has been lost and the clothing has been seriously soiled it should be cut off so as to avoid exertion on the part of the patient.

For a few days the ice-bag may be kept over the heart, provided no pleurisy exists in this region. The patient may be allowed to suck ice, which not only quenches the thirst, but tends to quiet the cough. Some patients are unable to take ice in this manner because to them it has a nauseating effect.

The patient's diet should be limited to eight ounces of solid food and ten ounces of liquid a day for the first few days following a hemorrhage. The food may be warm, but hot liquids, such as soup, coffee, and tea, are not permitted because they are absorbed very quickly, tend to stimulate the heart and to increase the blood-pressure. By requiring the patient

to take a small amount of liquid at a time, and no more than ten ounces in twenty-four hours, the blood-pressure may be kept down while the break in the blood-vessel is healing. The citric acid fruits are best avoided. The patient should remain quiet in bed for a period of seven to ten days after all bleeding has stopped. Straining at stool must be avoided by the use of small doses of magnesium sulphate. During this time the arms should be kept in repose alongside of the body as much as possible. If adhesions bind a part of the lung to the chest wall, certain movements of the arms may cause stretching of the lung tissues with increase of bleeding.

It requires considerable nervous energy and causes some excitement for the patient to meet people; moveover, talking and laughing are dangerous to the patient. Therefore all visitors must be excluded and it is best that the patient see only the nurse for the first few days. The room should be well ventilated and cool, (50° to 60° F.), but the patient must be kept comfortably warm at all times, as chilling of the skin may increase bleeding.

At all times the nurse must reassure the

patient and endeavor to avert worry. If much nervousness is evident, narcotics may be required to produce the necessary rest. A few cases fail of response to general treatment and one may be compelled to resort to artificial collapse of the bleeding lung.

Treatment of Complications.—With pulmonary tuberculosis there occur certain tuberculous complications, such as laryngitis and enteritis, which in many cases add definite difficulties to the treatment of the disease. At one time it was believed that *tuberculous laryngitis* occurs only in hopeless cases, but now we know that this condition, although it usually accompanies pulmonary tuberculosis, may occur in very early and curable cases. Numerous local treatments have been devised for tuberculous laryngitis, such as the application of drugs and treatment by the electric cautery. In advanced cases the nerve supplying pain fibers to the larynx may be injected with alcohol or incised in order to relieve the pain and make it possible for the patient to take food and drink. In the early hopeful cases rest of the larynx is of great help. Such patients refrain from using their voices, even to

whisper, over the time necessary to bring about healing. Local and general applications of sunlight, natural or artificial, are found of much value. In the treatment of tuberculous laryngitis, in addition to the special methods mentioned, routine sanatorium treatment is indispensable. As the pulmonary disease heals and the patient's general condition improves the laryngitis usually shows definite healing.

Until recent years *tuberculous enteritis* was believed to be a terminal condition, but our present methods of making earlier diagnoses and our recently developed methods of treatment lead us to offer many cases of tuberculous enteritis considerable encouragement. This condition is often diagnosed before any symptoms have appeared. It is obvious that treatment begun in such early cases is more effective than in cases with extensive disease accompanied by marked symptoms. Many splendid results from sunlight, particularly artificial sunlight produced by the Alpine lamp, have been reported in the last few years. Patients suffering from extreme pain and diarrhea have been definitely relieved following

sunlight treatment. Tuberculous peritonitis also responds well to heliotherapy.

Occupational Therapy.—Early in the convalescence of most tuberculous patients a small amount of work, requiring very little mental or physical energy, may be undertaken. This should always be on prescription and, in the beginning, should consist of work, occupying short periods of time, which can be done while the patient sits quietly in bed. Knitting, basket-making, etc., are suitable. Later, longer periods of occupation and of somewhat more intensive type may be prescribed. During the period of convalescence most tuberculous patients feel well and they need something to occupy their minds. It is during this stage, when they feel well and look well, that they often doubt that they have tuberculosis. Impatient of progress, not a few forsake the strict regimen imposed upon them only to relapse at a later time.

Since the introduction of occupational therapy it has been possible to keep patients more contented and, hence, more willing to continue systematic care for a longer period. Prolonged treatment often prevents subsequent relapse.

Occupational therapy is so valuable in the treatment of tuberculous patients that many first-class sanatoria employ full-time occupational therapy workers. In certain localities these instructors are available for patients on home treatment. This kind of thing should be encouraged, aiding as it does not only the patient, but all entrusted with his care.

Vocational Training.—When a tuberculous patient has been on graduated exercise sufficiently long to justify his attempt at remunerative employment on a small scale, we should seek to learn something of the sort of work to which he must return when his working capacity is restored. If his regular vocation is likely to be consistent with his expected physical condition, an effort should be made to arrange for his undertaking the same form of occupation while he has to remain in the institution or the home. This may lead to a restoration of his working capacity while he is still a patient under careful observation. If, in consequence, a relapse threatens, it may be averted by reducing his work and requiring longer rest. When he is actually doing as much work as under ordinary circumstances will ever be re-

quired of him he may be discharged and allowed to begin earning a living.

For lack of early training certain patients may feel compelled to return to hazardous occupations when their period of treatment is ended. Such people should be trained, while still under institutional or home care, to some other kind of work and should develop a good capacity for it before they are discharged. For example, a person who has always done hard manual labor will, in all probability, be unable to return to it with any degree of safety. He should be taught to do such indoor work as bookkeeping or typewriting which will require little physical exertion. Objection has been raised to this substitution on the ground that indoor work has been considered unsuitable for ex-tuberculous patients. Recent observation, however, has shown that inside occupation, in well-ventilated quarters, combined with the use of well-ventilated bed-rooms or, better still, of sleeping porches in mild weather, is to be preferred to outdoor work which requires strenuous physical exercise.

Drugs.—Unfortunately there is very little benefit to be derived from the use of drugs, as

we now understand their use, except for the relief of special symptoms. Nearly every drug in the Pharmacopeia has been tried over and over again, with the result that the medical profession of today knows of no medicine that possesses any specific value in tuberculosis. For example, creosote had long been used because of its germicidal action and because it is excreted in small measure through the lungs. While this drug may aid somewhat in cleaning up small areas of infection in the lungs and bronchi, it has never proved a cure for tuberculosis. Again, calcium had long been a favorite among physicians, who believed that its continued use resulted in a deposit of lime salts around the tubercles, whereby the walling off of diseased areas might be promoted. Recent researches in blood chemistry, however, show that the calcium content of the blood is quite constant regardless of the amount of calcium taken by the mouth. It seems, then, that this agent, as administered to the tuberculous, is not so effective as it was once thought to be.

There are certain drugs, however, which are very effective in controlling symptoms and thus aid greatly in the treatment of the dis-

ease. One of the best examples is found in the group of cough sedatives. Contrary to the old notion, the tuberculous patient should not be allowed to cough unnecessarily or violently. Violent attacks of coughing not only irritate the lower respiratory passages but also tend to break down and prevent healing of diseased areas in the lungs. How often pulmonary hemorrhage is precipitated by violent coughing. Before a severe cough is brought under control by self-restraint, rest, and fresh air, which constitute the best treatment, the cough sedatives may be of great value in allaying this symptom. Such sedatives should be discontinued, however, at the earliest possible moment.

Marriage and Tuberculosis.—Inasmuch as tuberculosis attacks so many young persons before marriage, one is frequently asked whether the tuberculous should *marry*. This question can only be answered after a careful consideration of each individual case. If the disease is not too extensive and the patient is in reasonably good condition, marriage may be advised; particularly if, after marriage, the tuberculous patient will have an easier life and better care than before. For instance, a young woman

who had been a teacher and had been compelled to support herself, inquired, after a year of treatment, if it would be safe for her to marry. She had a moderately advanced degree of disease, but she was engaged to a young man with considerable wealth, who, knowing her condition, was willing to arrange the home so that she would have practically no enforced duties. In a word, she would have a much easier time after marriage than she could possibly have if she were compelled to return to teaching. I could not help but recommend marriage to this patient and ever since her marriage she has done splendidly. I have also seen tuberculous men marry whose wives were able to aid them definitely to permanent recoveries. The other party to the contract should always be informed of the exact condition of the tuberculous patient.

Marital Tuberculosis.—Many people believe that everyone who comes into intimate contact with an active case of tuberculosis develops the disease. This is not true and in no place do we find greater evidence of the falsity of this belief than in *marital tuberculosis.* One would expect that the wife or the husband of

a tuberculous mate would inevitably become tuberculous. On the contrary, however, Fishberg found that among 170 couples, of whom the husband or the wife was tuberculous, in only 2.5 per cent. were both of them diseased. Other observers have found that in only 3 or 4 per cent. of couples with tuberculosis in the one consort does it exist in the other. Often we see that after a woman marries a tuberculous husband, while all her children develop tuberculosis, yet she herself remains free. This has been designated *mother immunity*. Fishberg calls attention to the fact that analogous conditions are seen among married men and the condition is known as *father immunity*. We know that the husband who has a tuberculous wife usually shows definite evidence of having been infected, and vice versa; but apparently such an immunity develops in the body of the well consort so that he or she rarely becomes tuberculous again.

Pregnancy and Tuberculosis.—During the period of pregnancy we often see tuberculous women lose symptoms, increase in general body weight and apparently make very definite improvement. Upon the strength of these retro-

gressive changes during pregnancy we find older physicians recommend marriage for tuberculous girls. More recent observations have proved that while often an improvement of the patient is observed during pregnancy, yet after delivery the disease may progress at a rapid rate. Patients with apparently or definitely arrested tuberculosis may show a reactivation of the disease following delivery. The tuberculous woman who marries should be told that pregnancy, labor, and lactation may prove disastrous to her. The physician is justified in giving instructions to such patients for the prevention of conception. In spite of all instruction, however, some such patients will become pregnant and herein one is confronted with one of the most difficult problems in tuberculosis. Shall the pregnancy be terminated or shall the expectant mother be allowed to go on to delivery? There is a large number of physicians who strongly favor the termination of pregnancy in every case, while an equally large group just as strongly oppose it. I have always been of the opinion that this question cannot be and should not be decided by the physician, but that the husband and wife

should be given to understand clearly that there are definite dangers attending pregnancy and labor in the tuberculous mother and that these have cost many women their lives; while, on the other hand, many have gone through these experiences with no apparent ill results. The decision must be left with them. If they decide not to have the pregnancy interrupted, then the expectant mother must be placed on a strict antituberculosis regimen, and preferably in a sanatorium, throughout the period of pregnancy and for many months after delivery. The infant must be isolated from the mother as soon as delivery is effected in order to protect it from the receipt of an overwhelming dose of tubercle bacilli through contact.

Quacks and Medical Imitators.—Ever since the early history of medicine medical imitators have existed. Today these imitators include those who attempt to heal tuberculosis by the use of drugs, who attempt to heal it by manual manipulations, who attempt to heal it by faith, who attempt to heal it by means of mental control, etc. Quacks and certain patent medicine fakers make a tremendous appeal to many far-advanced consumptives who have become so

desperate that they are willing to grasp at the most minute particle of medicinal driftwood. No matter how extravagant its claims may be, there is no cure for tuberculosis in any patent medicine. This point has been very carefully investigated by Dr. Philip P. Jacobs, who has found, in every instance, that patent medicines merely contain cough sedatives, stimulants, or other substances which make the patient feel temporarily better, and eventually leave him in as bad or worse a condition than he was before.

When some of my personal friends among medical imitators have made exorbitant claims of the curability of tuberculosis by their methods I have often stated that arrangements would be made to throw open the doors of a sanatorium where many tuberculous patients are treated and to give them $500 for every patient they cure, provided they agree to give me $500 for every patient whom they fail to cure. Not one of them has ever accepted the challenge.

Our present-day medical imitators are drifting on a rough sea. They make extravagant claims, but they know nothing about the funda-

mental principles underlying disease. It cannot be long before the rough sea will hurl them upon the rocks with great violence and they will go down of their own weight. History has demonstrated over and over again that imitators, fakers, and the advocates of false method all go down to oblivion and are no more heard of forever except as blights upon the history of progressive civilization; while, on the other hand, the honest, upright, philanthropically endowed and fundamentally trained must in the end prevail.

Chapter VII

THE PREVENTION OF TUBERCULOSIS

The most hopeful aspect of the whole campaign against tuberculosis is the fact that it *is* a preventable disease. It is questionable whether we can ever prevent people from becoming infected. In fact, it is doubtful if we should attempt to do this unless we are able to annihilate the tubercle bacillus. Among such animals as dairy cattle, despite the slaughtering of the diseased, it has as yet been impossible to prevent the spread of tuberculosis. Our efforts for the present must be directed toward preventing a massive and overwhelming dose of tubercle bacilli reaching the human body. Since we know the primary places where tubercle bacilli grow in nature, and since the science of bacteriology has taught us that tubercle bacilli are easily killed by certain chemical agents and by heat, we attempt to destroy all bacilli possible and to prevent others from escaping from their foci of growth. Pre-

vention consists, too, in the avoidance of malnutrition and of those debilitating conditions which lower the resistance of the human subject to disease.

Since we know that bovine tuberculosis is transmitted to man primarily through dairy products and through the flesh of swine and other animals which the tubercle bacilli frequent, it would seem to be an easy problem to so inspect and treat these food products as to prevent live tubercle bacilli of the bovine type from entering the human body. However, the education of the public concerning the dangers of bovine tuberculosis has been so neglected in the past that in many places co-operation is lacking. In this connection tribute must be paid to the members of the veterinary profession who are doing so much to eradicate tuberculosis from domestic animals. Through extensive tuberculin testing and the destruction of animals reacting to the test much has been done to decrease the incidence of tuberculosis in cattle and swine. For example, the work carried out in the District of Columbia has shown what may be accomplished. There the incidence of tuberculosis among cattle has

been decreased from 18.87 per cent. in 1910 to 0.63 per cent. in 1919. The veterinarians showed that tuberculosis in swine is almost always contracted from cattle by feeding unpasteurized skimmed milk to the hogs and by allowing them to follow cattle and feed upon the undigested grain which the cattle pass. Hogs become tuberculous also by eating unsterilized garbage, carcasses of animals and fowls dying of tuberculosis and the infected offal of slaughter-houses. Table 1 shows how the incidence of animal tuberculosis is being decreased. It is very hopeful to know that at the present time the Meat Packers' Association is interested in co-operating with the National Tuberculosis Association in an attempt to more materially reduce this incidence.

TABLE 1

FEDERALLY INSPECTED CATTLE AND SWINE CARCASSES CONDEMNED ON ACCOUNT OF TUBERCULOSIS. (After Kierman and Ernest.)

Fiscal year.	Cattle.			Swine.		
	Slaughtered.	Condemned.	Per cent. condemned.	Slaughtered.	Condemned.	Per cent. condemned.
1917	9,299,489	46,351	0.50	40,210,847	76,807	0.19
1918	10,938,287	40,792	0.37	35,449,247	59,740	0.17
1919	11,241,991	37,600	0.33	44,398,389	65,838	0.15

In cities where health departments have proper authority bovine infection has been considerably reduced. Before the days of pasteurization of milk in New York City approximately 64 per cent. of the cases of abdominal and lymph-node tuberculosis were of the bovine type. At present 98 per cent. of New York City's milk supply is pasteurized and only 16 per cent. of the cases of lymph-node and abdominal tuberculosis are due to bovine germs. In every city, though it require pasteurization, a small percentage of the people will secure unpasteurized milk. Some families living near the city limits and keeping one or more cows will supply a few of their neighbors. Again, people coming from the country to visit relatives or friends in the city frequently bring a supply of "fresh" milk for the children. This condition can be overcome only through the proper education of the public. Many persons believe that pasteurization destroys the food qualities of milk, when, in reality, no element of food in it is destroyed except vitamin C, which is abundantly present in such other articles as tomatoes and oranges.

Since pasteurization absolutely destroys tu-

bercle bacilli in milk and does not affect its food qualities, *all milk should be pasteurized* before it is considered safe for human consumption.

Another method of protecting the public against bovine tuberculosis is to test all milch cows with tuberculin and to eliminate those found to be tuberculous. This method has been widely used, but it is far from infallible. An occasional animal with definite tuberculosis will not react positively to tuberculin. Moreover, there are animals which develop tuberculosis soon after a negative test has been reported. *Tuberculin testing of animals is a good practice, but it should be supplemented by pasteurization of milk in order to protect the public against this source of infection.*

Tuberculous animals are capable of casting off from their bodies large numbers of tubercle bacilli through the excreta and, therefore, *such animals should be destroyed* to prevent the tubercle bacilli from coming in contact with other animals in the same stables and fields, as well as with the persons caring for them.

It is true that many animals reach the slaughter-houses and are killed before tuber-

culosis is detected. Careful inspection of meats in slaughter-houses has done much to protect the public, but there always is the possibility of the existence of very small areas of disease invisible to the eyes of the most careful inspector. Further, one must consider the large numbers of animals that are killed by farmers for home use and are not submitted to inspection. The safest procedure is to educate the public to *eat only well-cooked meats*, whether or not they have been inspected.

If all sputum, feces and urine, and all fluids from tuberculous processes, as pus from tuberculous abscesses, could be destroyed in such a way as to kill all tubercle bacilli the spread of tuberculosis from one person to another would be checked. Unfortunately, the education of the public has been so much neglected that many persons, who know themselves to be the subjects of tuberculosis, do not know of the danger of their excreta to others. Other tuberculous individuals are not aware of their own disease. They go about from month to month innocently spreading tubercle bacilli. Education will, in time, do much to acquaint such persons with their physical condition and

with the means of protecting others. Nevertheless, there will still be the occasional tuberculous person who has no regard for others, and who, though he knows he is jeopardizing the health of others, insists upon disregarding all preventive measures. In such cases one should be able to resort to compulsory laws in order to place such a one in a detention hospital where he cannot be a menace to others. In some States laws covering such cases already exist. Too frequently, however, public sentiment is lacking and law enforcement remains very difficult, if not impossible, to achieve.

It has been proved by experiment that many tubercle bacilli may be ejected from the mouth during coughing and sneezing. Therefore, all patients should be instructed to *cover the mouth* with a piece of gauze or a paper napkin during these acts. The squares of gauze or the napkins are then placed in a paper bag, and every twenty-four hours or oftener the bag is closed tightly and burned in so hot a fire as to insure the immediate destruction of the tubercle bacilli. All sputum is collected in sputum containers and similarly burned. The feces of all cases of active pulmonary tuberculosis and, in

some cases, the urine should be subjected to germicidal agents. In cities and sanatoria, where proper disposal is made of sewage, the bacilli are all destroyed, but in places where adequate sewage systems do not exist these excreta may be rendered free of danger by treatment, for an hour or more, with a three per cent. carbolic acid solution.

The mouth of the active tuberculous patient may contain bacilli at any time and, since it is so common a thing for persons to place the hands about the mouth, it becomes necessary to insist that the patient's hands be washed frequently with soap and water. Hand shaking is a dangerous practice unless the hands have been washed just before.

The eating utensils of tuberculous patients must be thoroughly sterilized. This is done on a large scale in first-class sanatoria, but it may not be done with equal thoroughness or it may cause so much inconvenience as to be neglected in the home.

Since we know that persons who are apparently perfectly well may be tuberculosis carriers it is obvious that we must begin to seek them out as we now do typhoid and diphtheria carriers.

In addition to our attempts at prevention of the spread of the tubercle bacillus, we must fight desperately against conditions which render people susceptible to this disease.

Malnutrition is unquestionably an important ally of the tubercle bacillus. This condition is usually due to poverty, ignorance, or disease. If consequent upon poverty, we can do much by interesting charitable organizations in deserving families. Such organizations suffer much from imposition but they always appreciate our aid in the selection of the needy.

If malnutrition is due to ignorance of food values, much may be done to educate those in charge of the choice and preparation of family foods. They must be taught the importance of a variety in food-stuffs which will insure an abundance of all the nutritive elements, including the vitamins.

If malnutrition is due to such local disease as infected tonsils, adenoids, teeth, or any other foci of infection, our efforts should be directed toward the removal of these sources of trouble. Very often the nurse can do more than the physician toward convincing people to have such minor operations as tonsillec-

tomy or teeth cleansing and correction attended to.

Wherever it has been intelligently practised school feeding has done much not only to prevent malnutrition among school children but also to teach parents important facts concerning food. Moreover, older children learn many lessons about foods which will insure better nutrition to those of the next generation.

Special nutrition clinics, as they are carried on with children at the out-patient department of the Boston Consumptives' Hospital, are capable of much good, since the instruction offered is carried back into the home and much malnutrition is overcome or prevented.

In the past splendid work has been done in the prevention of tuberculosis. A glance at Fig. 15 shows that the number of sanatoria has grown very rapidly in this country and that they now have a combined capacity of approximately 66,000 beds. When we look back to 1890 and find statistics of only 1674 beds, and then consider that a brief period of less than forty years has elapsed we are impressed with the rapidity of this development.

One of the sanatorium's closest allies is the

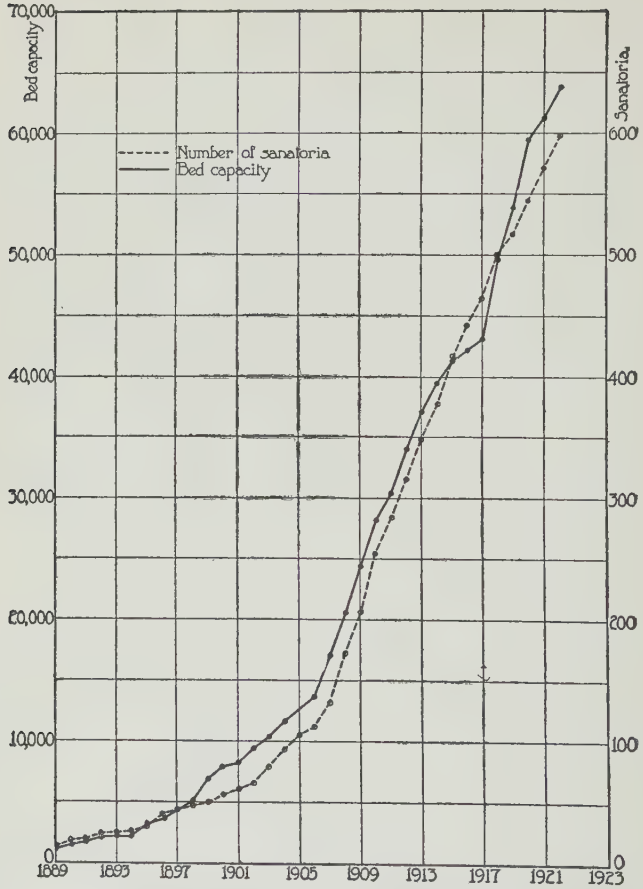

Fig. 15.—Curves showing the development of sanatoria and increase in capacity in the United States from 1857 to 1922.

preventorium, which should admit persons who have been exposed to tuberculosis, who are malnourished or are below par in any other

respect—who, in short, are in danger of developing tuberculosis. In such preventoria these persons should be restored to good health in a short time. A few months spent in such an institution may prevent years of invalidism.

It is strongly hoped that more general hospitals will soon open private rooms or wards to tuberculous patients. With the extremely limited sanatorium bed capacity the general hospitals in this country could do much to relieve the situation. They not only would save lives, but would prevent greatly the spread of tuberculosis. Moreover, they would stimulate the interest of physicians other than tuberculosis specialists, which would result in earlier diagnosis and a more general education of the public in a much shorter time.

Along with sanatorium building other factors have been introduced, not the least of which is public education. The strenuous efforts of those who have labored to prevent tuberculosis in the past have been crowned with a gradual but unmistakable reduction in the death-rate during the past fifty years, as shown in Fig. 16.

Education must be introduced into observation hospitals, sanatoria, preventoria, schools

for tuberculous children, and in every place where an opportunity to discuss tuberculosis presents. A course of teaching in tuberculosis, introduced into all schools, would do much to prevent tuberculosis in future generations. The following quotation from Dr. Lawrason Brown is significant: "In the ten or twelve years after

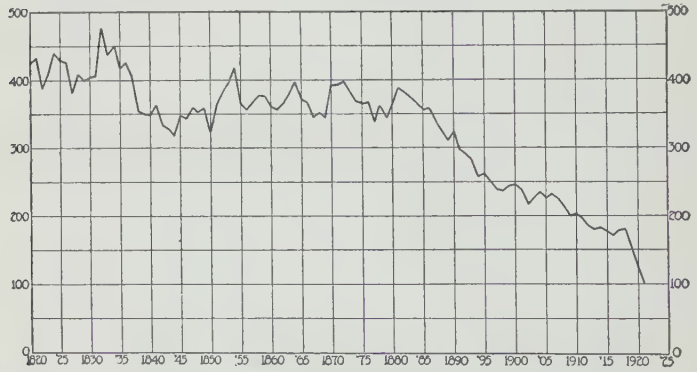

Fig. 16.—Shows decrease in mortality from tuberculosis of the lungs in the cities of New York, Philadelphia, and Boston from 1820–1921. (From data furnished by Prudential Insurance Company of America.)

graduation from high schools most cases of tuberculosis start. This brings the boys and girls to the third decade, which is, of course, the period of greatest stress and strain in life; it is the change from the protection of the schools to the strain of business, the years when they forget themselves in study, in work,

and in play. I have felt for a long time that if we could bring before the youth of our country the fact that they are going to form in the next ten or twelve years the future sufferers from tuberculosis and help them by what simple rules they could apply to prevent contracting the disease, we could further reduce the mortality from tuberculosis."

After our greatest efforts have been made, tubercle bacilli will still be spread about ignorantly, carelessly and accidentally, thus making infection possible at all times. Some will continue to overwork, to contract other debilitating diseases and to practice harmful indulgences in excess. Nevertheless, time spent in preventive work is well spent, for this work has been, and will continue to be, productive of a much reduced incidence of tuberculous disease which, in turn, will result in the prolongation and saving of human life as well as in the prevention of much physical suffering in the sick and of much mental agony among their relatives and friends.

In all preventive work applied to tuberculosis there is no group of persons capable of rendering so great service to the public as may

nurses well trained in the science of this disease, possessing the good judgment which directs tact and the personality which wins and retains the confidence of the people.

Although the work in the prevention of tuberculosis may seem at times discouraging, we must catch the vision of much greater accomplishments than have ever been thought possible in the past. With the purpose it inspires we must make use of every available agent and work more diligently even than our forefathers have worked. For "where there is no vision the people perish."

Chapter VIII

THE ECONOMICS OF TUBERCULOSIS

The cheapest thing in the world is money, yet it holds so complete mastery over the popular mind that often we may make the importance of the tuberculosis problem the better understood by attempting to reduce the cost of the disease to a financial basis. The total tax of tuberculosis upon the world throughout the past can never be fully appreciated, for exact figures would be impossible to obtain and, if obtainable, would reach beyond the range of human comprehension.

The cost of tuberculosis among live-stock and particularly among food-producing animals is tremendous. The figures in Table 2 give us some idea of the number of cattle and swine retained and condemned each year at establishments where Federal meat inspection is conducted; but approximately 35 per cent. of all the animals slaughtered each year in the United States are killed in establishments not under medical supervision, and therefore the

figures in Table 2 do not tell the whole story. "When animals are 'retained' by the Federal Inspectors on account of tuberculosis it means that some evidence of disease is discovered and the carcass is placed aside for further examination. If the disease is found to be so slight as to render the undiseased portion of the carcass fit for food, the diseased area is removed and the remainder is passed." When an animal is condemned it means that the disease is so extensive that the entire carcass is unfit for human food. Wilson has shown that from June, 1920 to June, 1921 the meat inspection division of the Bureau of Animal Industry condemned and destroyed enough meat to supply more than 180,000 American citizens for one year, allowing 154.3 pounds per capita.

In addition to the loss of meat caused by tuberculosis there is often great loss to dairy herds. Tuberculin testing of herds has shown that from 1 to 50 per cent. of cattle are infected with tuberculosis. Some herds are so badly infected that following these tests it becomes necessary to kill as many as 50 to 90 per cent. If this happens to a dairy herd it is obvious that the animals sacrificed are worth much more to

TABLE 2

NUMBER OF CATTLE AND SWINE SLAUGHTERED, AND THOSE RETAINED AND CONDEMNED ON ACCOUNT OF TUBERCULOSIS AT ESTABLISHMENTS WHERE FEDERAL MEAT INSPECTION IS MAINTAINED. (After Kierman and Wight.)

Fiscal year.	Cattle.			Swine.		
	Slaughtered.	Retained.	Condemned.	Slaughtered.	Retained.	Condemned.
1908	7,116,275	68,395	24,371	35,113,077	719,279	77,554
1909	7,325,337	100,650	24,525	35,427,931	860,425	45,113
1910	7,962,189	123,501	27,638	27,656,021	792,176	28,880
1911	7,781,030	133,551	27,186	29,916,363	1,117,789	31,517
1912	7,532,005	160,122	35,273	34,966,378	1,643,100	42,267
1913	7,155,816	152,560	33,001	32,287,538	1,809,751	47,632
1914	6,724,117	143,699	29,738	33,289,705	2,201,005	48,252
1915	6,964,402	158,239	32,644	36,247,958	2,774,835	66,023
1916	7,404,288	190,991	37,085	40,482,799	3,687,817	74,109
1917	9,299,489	218,928	46,351	40,210,847	3,978,168	76,807
1918	10,938,287	222,787	40,692	35,449,247	3,494,587	59,740

the dairyman than the beef price which he is compelled to accept. Kierman and Ernest call attention to herds, bringing a net profit of $600 to $700 per month, which had to be destroyed because of unusually prevalent tuberculous infections. Such instances not only represent terrible losses to the dairymen but also to the public supplied by them.

Even more costly is tuberculosis when it invades fine pure-bred herds. Animals valued at several hundred dollars apiece are just as sus-

ceptible to tuberculosis and must be treated in the same manner as the less costly and less valuable ones. A case cited by Kierman and Ernest is that of a breeder who was compelled to send 45 of his 70 pure-bred cattle to the slaughter-house because of tuberculosis. He estimated the cost at from $20,000 to $30,000.

It was estimated that for the year 1917 tuberculosis among cattle alone cost this country approximately $40,000,000.

Many serious losses have been caused by tuberculosis in swine. As many as 25 to 100 per cent. of the animals in droves of swine may be infected with tuberculosis. Kierman and Ernest have called attention to one instance in which 68 hogs were shipped from a single point in one State, and upon their arrival at the slaughter-house all were found to have tuberculosis, and 33 of them were so badly diseased that they had to be entirely condemned as unfit for food. In discussing tuberculosis in hogs Mohler says: "The suppression of this disease would save the country many millions of dollars annually."

In considering the cost of animal tuberculosis we must not overlook the extra expense

incurred to make dairy products safe for human consumption. Certified milk is sold at a price much beyond the usual retail cost of milk because of the extra care and work involved in producing it. Pasteurization, the only process we now have for making milk safe, involves a great deal of additional expense to the public. However, pasteurization will probably always be necessary, regardless of the danger of tuberculosis, to remove dangers of other kinds of infection, such as colitis, scarlet fever, typhoid fever, etc.

The losses by animal tuberculosis through the condemnation of carcasses have been so great as to arouse the intense interest of the meat-packers in the suppression of the disease. In fact, the buyers for certain packing houses are avoiding certain regions of the country where animal tuberculosis is known to be prevalent. Others buy animals with the understanding that the sellers bear all losses after postmortem examination of the animals has been made in the slaughter-houses.

The cost of tuberculosis in the human family is not easy to estimate. Authorities on the subject have placed the charge each year upon the

people of the United States at between $330,000,000 and $1,600,000,000. These figures are appalling, and yet, nevertheless, careful analysis of the situation compels the realization of the facts. It is a terrific loss to the country to educate children and to let them die of tuberculosis before reaching the productive age. It has been shown that in the State of Illinois alone $1,187,000 is spent annually upon the education of children who die of tuberculosis before the age of twenty years is reached.

Since the death-rate from tuberculosis has been so materially diminished we suffer annually in the United States approximately 100,000 deaths from this disease. When one considers that a high percentage of those who die of tuberculosis are in the most useful period of life—between the ages of eighteen and thirty-six years—one is impressed with the fact that the cost of tuberculosis is much greater than that of a disease like cancer which takes its greatest toll in the period of old age—in the decline of life.

In estimating the cost of a single case of tuberculosis we must consider not only the loss of wage-earning capacity, the actual cost

of taking care of the patient and the support of dependent members of his family but also the loss of future years of service in the event of death or of years of invalidism. About the smallest income that will properly support a small family at the present time is $140 per month. If the head of such a family becomes tuberculous the loss in earning capacity alone amounts to approximately $1680 per year. If he goes to a county, city, or state sanatorium the actual cost of his care to the institution is usually more than $2 per day, which amounts to something more than $700 per year. Someone must meanwhile support the family and this can be done for only slightly less than the patient's former income. If the patient is twenty-five years old when the disease is detected, and dies after two or three years, or becomes an invalid for a long time, many years of earning are sacrificed. It is a fair expectation that such an individual would normally have been able to work for at least twenty years. His earning capacity would naturally increase, but should it not, the ensuing cost is obtained by multiplying $1680 by 20.

It is obvious that the cost of tuberculosis to the United States is large for any single year, and the figures must increase tremendously when we take into consideration the whole world. The attempt, as we have already said, at an appreciation of the price the world has paid for tuberculosis throughout the entire past of the race would be equally beyond mathematical computation and human imagination.

In discussing tuberculosis from the economic standpoint we must be ever mindful of its heavy costs in happiness and life itself. When tuberculosis appears, happiness—that important element in human living—is substituted by such unpleasant factors as agony, suffering, sorrow, and depression. These affect not only the patient, but they detract very materially from the happiness of his relatives and friends whose efficiency is consequently reduced.

In this world there is nothing so precious to us as life, yet tuberculosis snatches it away from 100,000 American citizens every year. In the World War our country lost approximately 50,000 young men. That was a terrible loss—an awful sacrifice—and yet, since the World War, tuberculosis has cost our country more

than 600,000 lives and mostly of its young women and young men.

The economic cost of tuberculosis in the United States may be estimated reasonably closely each year. This cost seems large, yet it sinks into utter insignificance besides the costs in happiness and human lives.

Chapter IX

THE PSYCHOLOGY OF THE TUBERCULOUS PATIENT

We have been told that each tuberculous patient has a personality peculiar to this disease, but I am convinced that the psychology of tuberculous patients is pretty much the same as that of any cosmopolitan group of individuals, except that in certain cases the nervous system may be somewhat more unstable than the average. In working with tuberculous patients we are compelled to deal with all degrees of mental development from the unmistakably subnormal to the very keen and highly educated mind. It is obvious, therefore, that the first reaction to the tidings that tuberculosis exists and the subsequent attitude toward its treatment will vary a great deal with individual development. The mentally subnormal who may not appreciate the seriousness of the condition will show little or no concern regarding it. On the other hand, the young man of good mental development and education, who has a small family and no money

excepting what he earns, and is possibly in debt for his education—who is looking forward with great anticipation to a success in life which will means prosperity and happiness—is terribly shocked when he is first told that he has tuberculosis. Unfortunately, in the public thought a diagnosis of tuberculosis is synonymous with a gradual but sure wasting away of the body, terminating in death. The young man shares that conception, perhaps, and the shock he receives upon being informed that he has this disease may completely change his mental attitude for the time being. He visions a complete loss of earning capacity, an accruement of debts, the possibility of having to leave home, the danger to other members of his family of infection—in short, life appears to have fallen into failure. Although such a shock may seem hard to bear, the physician should always inform the patient that tuberculosis exists, for the information is less harmful in the end than a long period of uncertainty followed by a realization of the facts after the disease has become more advanced. After he is told that tuberculosis exists a long conversation between the patient and his relatives

and his physician should follow. All of them must be convinced that tuberculosis is a curable disease if treated sufficiently early and sufficiently long. The mental attitude of the patient may be greatly improved, and he may consent even then to go to a sanatorium for treatment. Following this conversation and while the patient, during the next few days, is still at home, many of the good neighbors will come in—not to offer any much needed help, but to give a bit of advice as to what ails him and how he may get over it. It is during this period, when a mental relapse into despondency is almost certain, that the nurse well trained in tuberculosis and with a good understanding of human psychology can do so much to restore the mental equilibrium of the patient. It is during this period that the fake healers obtain the name of the patient and send their representatives to "talk up" their particular method. On many an occasion I have been asked by patients who had been so solicited if there is any efficacy in these systems of cure. In one instance one of these healers happened in the home at the same time the physician was calling. The healer immediately began to recite

his remarkable cure, whereupon he was invited into the kitchen to observe a number of flies collected upon the ceiling. The physician told him that if he would pray away those flies or get him into such a mental state by his methods that to him the flies did not exist, he would believe firmly in his claims. He answered that such a demand was unfair, as the flies were entirely different from the causes of the patient's condition. What that healer needed most was education, for he did not know that tubercle bacilli were the cause of the disease and that they are living organisms even more difficult to destroy or to pray away than the flies. We all believe in prayer and recommend it strongly to the tuberculous patient, for it does much to keep him in the right mental attitude. Only we do not believe that the patient should pray and immediatcly stop putting forth every reasonable effort to get well.

After the patient is admitted to a first-class sanatorium he usually feels a sense of security in the fact that everything possible is being done for him. The other patients in the institution feel so well that often they play many pranks upon the new-comer. For example, one

new patient no sooner threw his weight upon the bed on the first night than it completely collapsed. Another in retiring found his feet in direct contact with a cold, but living horned toad. Still another was told of snipe hunting, and after dark on a chilly and rainy fall night was taken to the top of a hay-stack to hold a bag while the others drove in the snipes. He was left there many hours and, already in a bad condition, developed pneumonia and died three days later. This is in no way different from the psychology of perfectly normal persons in a group, say, of college students who play the same pranks. Patients who indulge in such jokes mean well, but have never been taught or have forgotten that in a sanatorium they may greatly endanger the lives of their subjects. Hazing of new patients in sanatoria occurs without the knowledge of the nursing or medical staffs. Every effort should be put forth by both the staffs and patients to bring about its abolition.

If the new patient does well in the sanatorium he soon has energy to spare and takes great delight in helping to create an atmosphere of fun about the institution. Many discharged

sanatorium patients state that they never had a better time, nor were happier in their lives, than during their stay in the institution.

On the other hand, if the patient has extensive disease and does not respond well and readily to treatment quite a different mental attitude may be met. Because of his disturbed reflexes and the disease toxins accumulating within him he may be in a constant state of depression, his digestion so impaired as to make most food repulsive, his rest at night unsatisfactory, and a sense of growing weakness overcoming him. Without efficient management this patient soon presents a terrible mental state. If he is in the home the other members of the family may find it impossible to tolerate his abuse and be compelled to employ a private nurse. If he is in the sanatorium he finds fault with the food, with his bed, with the other patients, with the nurses, with the physician—in short, everything goes wrong. Such a patient is to be pitied, for he is most miserable. By a careful study of his psychology it is remarkable how he may soon be so mentally changed as to see again only the bright side of life.

When the sanatorium patient returns home he may be overcome by a new deluge of diagnoses, of advice as to special treatments, and a variety of prognoses. Some good [uncle will point out that the physician must have made a mistake because no one could ever look so well who had had real consumption. A former employer will insist that the rest periods should be discontinued and strenuous exercise substituted in order to harden his muscles and improve his "wind." A splendid old grandmother will tell how she lost three husbands from consumption, and how all through her life she has observed that an increase in weight is invariably a bad sign—in fact, she had never known anyone "to be worth two cents after taking consumption."

Another kind person, who assumes the responsibility of the care of the case, is so overcautious that she complains if he talks, if he takes even the exercise prescribed by his physician, if he does not wear a certain kind of night-cap, if he does not wear a chamois-skin jacket, if he does not eat "lots of eggs and drink lots of milk." In fact, most physicians have to treat home-returning patients whose ner-

vous systems are so irritated by friends and attendants as to make it impossible to reduce their symptoms farther—much less to even hope for an ultimate arrest of the disease.

We have said that the tuberculous patient is apt to have a somewhat disturbed psychology—first, because of the very fact that he knows he has tuberculosis and suffers from the untoward influence of relatives and would-be friends; second, because the toxemia of the disease definitely affects his nervous system; third, because the sufferer with tuberculosis, in consequence of past experiences or hereditary taint, may always have had an unstable nervous system.

With all these facts in mind it is obvious that the tuberculous patient must have as much or more attention paid to the nervous system as to the tuberculous lesion, since the tuberculous lesion heals much more readily when the patient is mentally at peace. Therefore, any condition or act which causes the tuberculous person worry or unhappiness should be removed or discontinued. The author recalls one patient, in a rather toxic state, who was terribly irritated by the scratching of her

husband's pen near her bed. Had the husband become indignant and expressed himself accordingly it would have been only to heap dry fuel upon live coals.

All persons dealing with tuberculous patients must come to realize that the nervous temperament of the patient plays a dominating rôle in the course of the disease. For this reason Dr. Trudeau, after examining two patients found to have disease of approximately the same degree, would sometimes give advice to one almost directly the opposite of that given to the other. The one was the type who had to be frightened in order to make a sufficient impression to insure his co-operation in treatment. The other possessed such a nervous temperament that only encouraging words were necessary or even safe. It is obvious, therefore, that tuberculous patients must be treated individually rather than by general rule, since a rule that might be effective in one case might do definite harm if applied to another.

There is no one who is in more intimate contact with the patient and has a greater opportunity to influence his mental attitude than the nurse. She must insist upon dis-

cipline, but at the same time she must be sympathetic and kind. I have seen a few patients not only fail to improve, but actually decline in health, because of the unkind and unsympathetic treatment of nurses. On the other hand, I have seen many nurses who enjoyed the much greater respect and confidence of the patients than the doctors of the institution they served were able to command. Some nurses have few or no disciplinary problems, their patients are always happy, and for the most part do splendidly upon sanatorium treatment. One reason why some nurses, on the other hand, are not successful in sanatorium work is that they do not understand thoroughly the nature of the disease and the psychology of the tuberculous patient. Many of these patients look forward to a life of invalidism, while others have hope and the opportunity to become well after a very prolonged course of treatment. They have had to give up, at least temporarily, their lifework, their homes, and all the prospects for which they had been prepared and toward which they had striven with great anticipation. Admitted to the sanatorium, some are discour-

aged, sensitive, and bear a bad outlook upon life. Nevertheless, there is no group of people in the world who are more susceptible and responsive to sympathy and kindness than tuberculous patients. Nurses who have recovered from tuberculosis are usually very successful in sanatorium work because they know from experience the psychology of the tuberculous patient.

Whether it be nurse, physician, or friend who has to gain it, the complete confidence of the patient must be gained. When be believes that his relatives and friends in charge of him are more interested in his welfare than in anything else, when he believes that he has found the most skilful physician, when he believes that he has the most efficient nurse, when he is convinced that not one stone will be left unturned to restore his health, then, and not till then, will his attitude be right. Then there is no problem of discipline, for he is willing to carry out religiously the regimen which he is told to be the best for his particular case.

Chapter X

THE OPPORTUNITIES FOR NURSES AND THE RÔLE OF NURSES IN THE TUBERCULOSIS CAMPAIGN

Of tuberculosis it has been said that childhood is the seed time and adult life is the harvest time. Von Behring said, "Tuberculosis of the adult is the end of the song begun at the cradle." Tuberculosis has been such a menace to the human family as to acquire the title of the Great White Plague. It has caused untold suffering for both man and beast. It has never been a respecter of persons. Its victims range from the money magnate to the pauper, from the infant in arms to the helpless aged, from great national executives to worthless tramps, from the most highly educated to the most illiterate, from the white to the black races—in short, no nation and no class of people is safely protected from its ravages. Somewhere in the world a person dies of tuberculosis every minute and throughout the world one grave in every eight is dug for a person dying of this disease.

Because of the prevalence of tuberculosis, because of its chronicity and because it affects people in all ages and walks of life, it is obvious that much help is needed by those afflicted. Today there is no phase of medicine which offers greater opportunities for well-trained nurses. This is true not only because of the volume of work required but also because of the variety of work, the reasonably well-regulated life, and the financial remuneration which this field offers.

Tuberculosis nursing resolves itself into three main fields, as follows: private duty nursing, institutional nursing, and public health nursing.

Private Duty Nursing.—Nursing a tuberculous patient is so different from nursing patients suffering from other conditions that special training in tuberculosis is rapidly becoming quite essential and is demanded of the nurse by those who require her services. The nurse who becomes well informed on this subject often finds the demands for her services greater than even she had anticipated. There are patients, well-to-do financially, who prefer to employ a well-trained nurse and physicians specializing in tuberculosis and to remain at

home. Others, because of the limited sanatorium capacity, are compelled to remain at home. Many such patients require the services of private nurses.

The duties of private nurses in the care of tuberculosis consist in maintaining discipline and insisting that the physician's orders are carried out to the letter. In fact, the general management of the case should be the same as that described in Chapter V. Some private cases are treated by one or more of the special methods, as, for instance, heliotherapy and pneumothorax. The private nurse, then, must be familiar with all these special methods of treatment described in Chapter VI. Her technic must be such as to prevent the transmission of tubercle bacilli to other members of the family and to those visiting the patient. It is needless to say that the nurse who is not well informed upon tuberculosis, who is not kind and sympathetic, who is not capable of maintaining discipline as well as of making the patient happy, will not be retained by those able to pay for first-class nursing. The private nurse, therefore, in most cases will be paid and retained in proportion to her ability to

render real service, that is, to aid the patient toward his goal.

Institutional Nursing.—The sanatorium for the tuberculous offers wonderful opportunities for nurses desiring institutional work. One disadvantage of sanatorium work is due to the unfortunate fact that, in the earlier days of sanatorium building, these institutions were so terribly isolated from social centers as to make nursing positions undesirable. Often they were located many miles from a railroad station. Modern developments, particularly the invention of the automobile and good road-building programs, have done much to overcome the isolation of sanatoria which were intended to be isolated. Moreover, the National Tuberculosis Association recommends strongly that in the future all sanatoria be located near large towns or cities.

Another stumbling-block is the fact that a great many people are suffering from phthisiophobia (tuberculophobia). This consists in an unreasonable fear of tuberculosis and of those suffering from it. It is due to a lack of knowledge concerning tuberculosis. A Philippino student whom I sent to a sanatorium

a few years ago suffered so from the fear that he would contract more tuberculosis from the sanatorium patients that he was miserable. After leaving the dining-room he would gather up a handful of grass to prevent his hand from coming in contact with the door-knob of his cottage. This may be overlooked in laymen whom we have failed to educate properly, but we may wonder whether we have not failed in our educational efforts in professional schools when we see nurses and physicians suffering from phthisiophobia. Recently a first-class general hospital, not accepting tuberculous patients, made arrangements with a first-class sanatorium whereby the nurses in training at the hospital would live for a few weeks in the sanatorium where they would receive excellent training in tuberculosis. The fear of this disease was so entrenched in the minds of the pupil nurses and their parents that they registered objections sufficiently strong to cause the arrangement to be abandoned.

A graduate nurse, out of employment, recently came to me concerning a position in a sanatorium for the tuberculous. She admitted that she was suffering from a mild case

of phthisiophobia, while her mother was suffering from a severe one. Finally, because of fear, the nurse decided to remain unemployed rather than accept a splendid position where she would be associated with tuberculous patients.

There is no scientific basis for such fear of tuberculosis. There is no disease more easily prevented, since we know many of the sources of infection. This is particularly true around sanatoria where those in charge take great pride in teaching all patients and employees how to prevent the spread of the bacilli. For example, Dr. Toan, of the Michigan State Sanatorium, has shown that in twelve years' among 857 employees (including nurses), only three cases of active tuberculosis have appeared. Even in these three cases it was very doubtful if the disease was contracted in the sanatorium. Equally encouraging reports have been made from other sanatoria. It is much safer for the nurse, physician, or layman to associate with a patient whose sputum is positive, and who has been trained to prevent the spread of bacilli, than to be found in public gatherings where many unrecognized and untrained patients may be present.

With the existence of approximately 600 sanatoria in this country and programs calling for the construction of many more, it is obvious that such institutions offer no small field for nurses trained in tuberculosis. Already the demand for such nurses is considerably beyond the supply.

When one considers the continuous employment, the well-regulated life, the salaries which include maintenance, the opportunities for serving humanity, one appreciates that there are many worthwhile advantages in institutional nursing.

The duties of the sanatorium nurse vary with the position which she holds. For example, certain duties of a supervisor of nurses will be quite different than those of a head nurse in charge of a heliotherapy ward. However, duties common to all sanatorium nurses are to do their best to keep the patients comfortable, happy, and contented in every way, while at the same time they follow religiously the routine and special treatment prescribed by the physicians. Some sanatoria employ social service workers and occupational therapy workers. Such positions are attractive to nurses

who desire to prepare themselves for these special phases of the work.

Public Health Nursing.—The opportunities in public health nursing are unlimited, since this work resolves itself into so many different phases. For example, visiting nurses are needed in cities throughout the country, county nurses are being placed in responsible positions in many states and school nurses are becoming very popular. In some places the work of public health nurses is so organized as to make it possible to assign certain nurses to tuberculosis work alone, while in other places the public health nurse finds tuberculosis cases constituting only a part of her work. Such organizations as State and county tuberculosis associations, local and State boards of health, boards of education, and public health nursing associations are now employing public health nurses to devote their entire time to tuberculosis work. Inasmuch as this kind of work requires nurses with considerable executive ability, in addition to their special training in tuberculosis, the salaries paid are quite attractive. Greater than the financial remuneration, however, is the opportunity to help guide the

destiny of a given area or community so far as tuberculosis is concerned.

Public health nurses devoting their full time to tuberculosis work attempt to locate all cases of tuberculosis in the areas assigned them. They arrange for periodic examinations, with free clinics for the poor or consultations with private physicians for those able to pay. All cases suspected of tuberculosis are urged to accept examination. Cases who have returned home from sanatoria are kept under careful observation. The public health nurse should devote herself diligently to the public health education of the people of her district. She stands in a position to impart much information concerning tuberculosis to the public.

In the country districts tuberculosis usually constitutes only a part of the public health nurse's work. However, her duties toward tuberculosis cases are the same as those that apply to nurses devoting their entire time to this work.

In Fig. 17 we see represented schematically the course through which the public health nurse should be able to take her tuberculous patients. It is in the home that most of the

work must be done. Here the nurse must often devote considerable time to securing the consent of the suspected case to an examination. Then she must call to take the suspect to the examiner's office. If it is found to be a tuberculous or even a questionable case, she

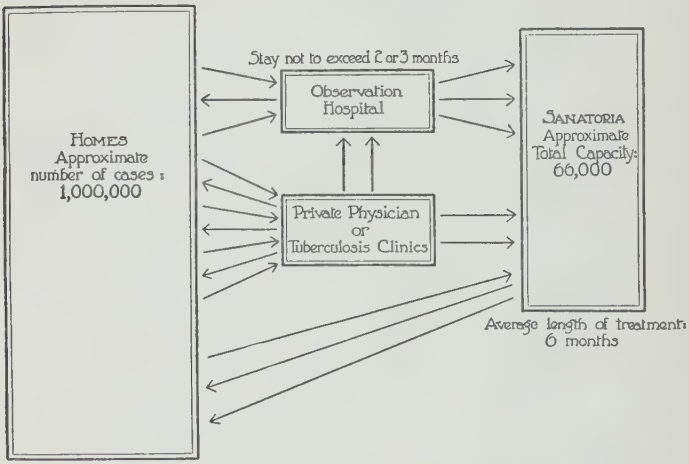

Fig. 17.—Diagram to show the courses through which the public health nurse should be able to take her adult suspects and frank tuberculous patients.

must work hard in the home to secure the consent of the patient and his relatives to submit to a period in the observation hospital of the sanatorium. The nurse must be well acquainted with sanatorium treatment in order to answer the prospective patient's questions.

Moreover, if she is able to describe accurately the routine of a sanatorium and give the reasons for each procedure, her patients will remain longer in the institution than they would otherwise, since they become reconciled to a long period of treatment. Many patients go to a sanatorium with the idea of spending a few weeks in fishing, hunting and picnicking, and returning to their homes with good working capacities. Upon arrival their hopes of a pleasant time are blighted when they are made absolute bed patients for six weeks or longer. In the face of discouragement, homesickness, and disappointment they not only leave the institution but also have lost confidence in their home nurses or physicians. Most of this may be avoided through instruction from the well-informed nurse before the patient leaves home. Then she should get the application ready for the physician's report and signature. All is not over when the patient is admitted to the sanatorium, for many of these patients, because of homesickness, return home soon after admission. The residence of most patients in sanatoria is, in fact, brief. The average time spent there is approximately six months.

Therefore, after this short sojourn in the sanatorium, during which time it is impossible for the patient to become completely restored to health, the nurse must resume her work as one of tremendous importance. In fact, the post-sanatorium care is as important as, and in some cases more important than, the sanatorium treatment. No less an authority on tuberculosis than Dr. John B. Hawes, the 2d, says: "The whole question of the results of our sanatorium treatment is so intimately bound up with the treatment of the patient after leaving the sanatorium—after-care work—that it is difficult, if not impossible, to tell which factor is most important, treatment in the sanatorium or the treatment of the patient after he leaves the sanatorium."

The school nurse is being employed in many parts of the country. She has demonstrated her value to the schools in so many places that she is now regarded as quite as indispensable as the teacher. In certain large cities the work of school nurses has been so arranged that a few nurses devote their entire time to tuberculosis among school children. This is particularly true where fresh-air schools and

special schools for tuberculous children exist. In the following paragraphs the statements made concerning the school nurse are equally applicable to the child welfare nurse and others working with children of preschool ages.

One of the duties of the school nurse is to select children for tuberculosis examinations. The children who should receive such examinations may be divided into the four following groups:

1. Children who have been exposed to tuberculosis.
2. Children who manifest constitutional signs and symptoms of tuberculosis.
3. Older children with localizing symptoms of pulmonary tuberculosis.
4. Children with physical deformities and defects.

Children of the first group consist of those who have been more or less intimately associated with one or more individuals suffering from active tuberculosis of the lungs, or with those who have eaten the products of tuberculous animals (bovine tuberculosis). Such exposed children may be arranged in three classes, as follows: (1) Those who have not become

infected. (2) Those who have become infected, but are not diseased. (3) Those who have actually become diseased. Such an arrangement into classes is possible, however, only after thorough examination. Therefore, every child who has been exposed should be examined.

The exposed child who is not infected may not yet have come in contact with tuberculosis germs, or his body may have been in such a condition as to prevent their invasion of his tissues. The infected child is one who has come in contact with the germs which have gained entrance to his body. Owing to certain resisting forces in the body these germs are quickly brought under control and are not allowed to make extensive invasion of the tissues. Nevertheless, they remain in the body in a somewhat dormant state. The child with tuberculous disease has come in contact with these germs; they have gained entrance to his body and have invaded the tissues. The germs may have made their invasion unopposed, or they may have met with considerable resistance and have possibly remained dormant for a time; but, for some reason, say

the occurrence of influenza, overwork, exposure, etc., the resisting forces have been overcome and the germs have continued an invasion which has resulted in such symptoms as loss of weight or failure to gain weight, weakness, fever, etc. The disease may be found in such organs as the lymph-nodes, the lungs, the spine, the hip, the larynx, and the intestine.

In cities where reporting of all cases of tuberculosis to the health department is compulsory it is not difficult to secure the names of children living in or closely associated with families where a case of tuberculosis has been reported. Unfortunately, not all cases of tuberculosis are reported; therefore, the nurse must be a careful auditor and observer, for in this way she may be able to locate many unreported cases in the homes.

In our great cities inspection and tuberculin testing of herds and pasteurization of milk are compulsory. However, one often finds a few individuals living near the city limits who keep one or two cows and supply a few of their neighbors with milk. Such individuals may escape the inspectors and often boast of being able to supply unpasteurized "fresh" milk.

This milk may be from tuberculous cows. Then, there is the relative or friend, living in the country, who pays an occasional visit and, without fail, brings a "quart of fresh milk to the children," which may be teeming with the germs of tuberculosis. This is a pernicious practice and no one has a greater opportunity to denounce it to the public than the school nurse. That the bovine type of germ plays an important role in childhood tuberculosis has been shown by a remarkably reduced incidence of certain forms of tuberculosis in children soon after the great cities made pasteurization compulsory.

When exposed children have been examined and are found to be uninfected or only infected without manifestations of disease, the nurse's duties do not end. If she is well informed upon tuberculosis she will know that this disease may develop very insidiously, that the germs may exist in a dormant state in the body for years, but that they are ever ready to take advantage of a propitious time to muster their forces and snatch away the life of their host. Therefore, the nurse should keep all exposed children under careful observation while

they are in school and turn them over to the proper agencies thereafter.

The second group of children to be examined for tuberculosis consists of those who manifest certain constitutional signs and symptoms, such as lack of endurance, poor play spirit, poor appetite, loss of weight or failure to gain weight over a period of four months, irritability, pale or sallow complexion, night-sweats, and fever. Many of these children may give no history of exposure to tuberculosis, but this should in no way influence the nurse. Tuberculosis is prevalent and many untrained consumptives cough and expectorate promiscuously; while others, unaware of their disease, innocently expose many children. Therefore any statement from a child or relative that there is no tuberculosis in the family and that there has been no exposure is absolutely insignificant. To be sure, there is no symptom or group of symptoms which in itself is diagnostic of tuberculosis. Nevertheless, any one of the symptoms mentioned is sufficient to arouse one's suspicion and to justify a careful examination.

The third group of children to be examined

for tuberculosis consists of those who have reached the age of eleven or twelve years or older. This usually includes children in the seventh and eighth grades and in the high schools. In the earlier years of life tuberculosis is usually a disease of the lymph-nodes, bones, joints, etc., and does not commonly make extensive invasions of the lungs. It is known as juvenile tuberculosis. In later childhood, however, the adult type of tuberculosis begins to manifest itself. Here we often see the lung tissue involved in a more or less extensive tuberculous process from which certain localizing symptoms are produced, such as pleurisy, hemorrhage, persistent cough and expectoration. Such symptoms may exist before constitutional signs or symptoms appear and hence will be the very first observed manifestations of disease. They demand examination at the earliest possible time. No tuberculosis program is complete which does not take into consideration high-school children. The high-school age is one of the most important ages from the standpoint of the control of tuberculosis.

The fourth group of children to be examined

for tuberculosis consists of those who show deformities or physical defects. Some children will show slight changes in the contour of the spine. If such changes are due to tuberculosis, the disease frequently leads to a hunchback deformity unless proper treatment is instituted early. Deformity, although slight, of any joint should prompt an examination for tuberculosis. Children with enlarged lymph-nodes or glands on the neck or elsewhere may have tuberculous disease of these nodes. Examination should be made of all children with discharging sinuses and ulcers of long standing.

In addition to the conditions and classes of children mentioned, other conditions will arise which will demand attention. At all times the nurse must rely a great deal upon her own good judgment in the selection of pupils for examination.

Another duty of the school nurse and child welfare nurse is to make sure that the children selected are given complete examination for tuberculosis, whether it be in a free clinic or in the office of a private physician. A complete examination consists of an extensive history of the past, together with the present symp-

toms; a thorough physical examination, plus temperature, pulse, blood-pressure, vital lung capacity, weight, and height; a laboratory examination of the urine, blood, stools, and sputum (if present); a tuberculin test applied to the skin, and a stereoscopic *x*-ray plate examination made by an expert roentgenologist.

A carefully taken history, together with the present symptoms, very frequently gives the physician valuable information concerning the course and location of the disease. However, if the data obtained are negative one should never conclude that the disease does not exist.

Physical examination may reveal very definite evidence of disease. On the other hand, negative physical findings in the chests of children are of very little significance, as the disease is very frequently limited to the internal lymph-nodes and even considerable enlargement of these nodes may escape detection by physical examination.

A tuberculin test applied to the skin is fairly good evidence of the existence or non-existence of tuberculous infection. It yields no information as to the time or location of the infection or whether disease actually exists. Many in-

dividuals have been stigmatized for life because a wrong interpretation was given to positive tuberculin tests. In childhood, however, the tuberculin test is slightly more significant than in adult life, since, if positive, we know infection could not have existed many years, and the child may require careful supervision for some time to make sure that his resisting forces are well established. The tuberculin test is not always reliable, since definitely infected cases may show a negative reaction immediately following certain acute diseases or in the presence of overwhelming tuberculous disease.

The *x*-ray examination is indispensable. Although a few cases will escape detection by the *x*-ray, the majority of cases of enlarged lymph-nodes at the roots of the lungs will be revealed by this phase of the examination in spite of the fact that physical signs are indefinite or entirely negative. Diagnoses of tuberculosis of the bones are also aided by the *x*-ray examination.

The school nurse will find that many children whom she takes for examination do not have tuberculosis. This is no reflection upon her judgment, but is an indication that she is

interested and alert and is carrying out her work conscientiously. Many symptoms which lead her to suspect tuberculosis may be due to other foci of infection, such as chronic appendicitis, infected tonsils or adenoids, carious teeth and chronic infection of the ear. No harm has been done in having these children examined for tuberculosis, and, in most cases, the cause of the symptoms will have been found, so that they may be referred to the proper clinics and physicians for treatment.

A third duty of the school nurse and child welfare nurse is to insist that the children be observed and to do her best to have the proper treatment instituted and continued as long as may be necessary for the restoration of their health.

Uninfected children with definite history of exposure and certain infected children somewhat below par should have their names placed on the list for frequent observation and reexamination.

Children with definite tuberculous disease, but at present in a non-active state, will do well in a special school for tuberculous children (Fig. 18). Such schools have developed from

the so-called fresh-air school which was first introduced scarcely twenty years ago in Germany. There the school was developed in a small forest, and hence it was named "The School of the Woods." The children spent most of their time out of doors. Our own nation was not slow to grasp this idea and only four years later a fresh-air school was

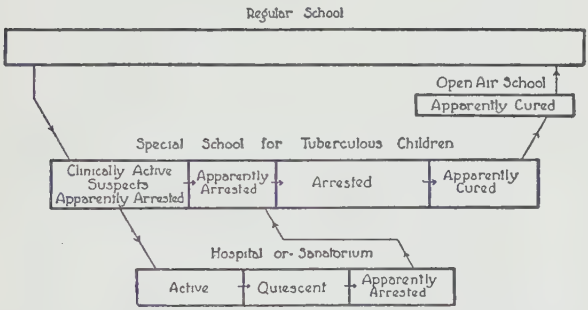

Fig. 18.—Diagram showing a practical method of caring for tuberculous children in city schools. (After Myers, Minnesota Medicine, August, 1923.)

established in Rhode Island. Since that time hundreds of fresh-air schools have sprung up throughout the United States and today these schools are being so named as to indicate the type of children they admit and treat, such as schools for tuberculous children and schools for anemic children. Schools for tuberculous children are a tremendous factor in our tuber-

culosis program. I am convinced that these schools have played no small part in the decline in the tuberculosis death-rate in the last few years. Such schools aim to detect the disease before it has done irreparable damage to the child's body; to segregate the tuberculous children from other school children so they may be more easily treated and will in no way jeopardize the health of others; to increase the child's resistance, through properly regulated living, so as to prevent spread of the disease or relapse at a later date; to teach the children and the community how to control tuberculosis; and finally, to give them such mental training as to enable them to develop into self-supporting and useful citizens.

Children who have active tuberculosis should be sent to the children's department of a sanatorium for the tuberculous. Here they receive the ideal treatment for tuberculosis and in due time may be returned to the school for tuberculous children.

Every nurse who desires to aid in combating tuberculosis must become and must keep well informed of the disease. She should read books by such recognized specialists in tuber-

culosis work as Hawes, Brown, Pottenger, Trudeau, Gardner, Krause, Otis, King, La-Motte, Jacobs, and Atkinson. To be insured that she keep up to date she should become a member of the National Tuberculosis Association, which entitles her to much current literature on the subject, including the Monthly Bulletin and the Journal of the Outdoor Life. In this manner she is able to keep abreast of the tuberculosis activities of the world. Such information stimulates keen interest which soon leads her to gain in favor with her patients and her fellow-workers.

When one considers the prevalence of tuberculosis one is amazed to learn that many training-schools offer their student nurses little or no instruction in this disease. No nurse should be considered well trained who does not have a reasonably good knowledge of tuberculosis and how to treat it. It is very unfortunate that so many general hospitals refuse to admit tuberculous patients, or at once discharge those admitted under some other diagnosis but later found to be tuberculous. This gives the student nurses the wrong impression concerning the treatment of tuberculosis

and also develops in them a fear of this disease. All general hospitals should follow the recommendation of the American Medical Association and the National Tuberculosis Association in opening wards for tuberculous patients. Such wards would not only stimulate interest in tuberculosis in the medical and nursing staffs, but also would save many lives. Some general hospitals are located in close proximity to sanatoria for the tuberculous. With such institutions it is usually possible to establish an affiliation whereby the nurses and interns in the general hospitals may receive their practical training in tuberculosis in the sanatoria. Nurses, by insisting upon training in tuberculosis, may do much to bring about the day when most general hospitals will admit tuberculous patients or will effect affiliations with sanatoria. Every undergraduate nurse is entitled to training in tuberculosis and should demand it.

Nurses who plan to do much tuberculosis work should take some post-graduate training in tuberculosis. In 1904 the Phipps Institute organized the world's first special training-school for tuberculosis nurses. Since that time

such schools have been organized in several other sanatoria. The National Tuberculosis Association is willing to furnish current information concerning such schools.

These special training-schools have graduated approximately 700 nurses. In addition, some of the great universities have organized courses for public health nurses in which the student may specialize in some phase of tuberculosis nursing.

After the tuberculosis nurse has gathered as much information as possible, she is prepared for one of the most important duties of tuberculosis workers, namely, the dissemination of information among the people. She must help to inform the public as how to prevent the spread of tuberculosis and how to control the disease which already exists. The members of a family usually have great respect for the well-informed nurse; hence they are in a receptive mood when she offers suggestions and instructions. I have seen well-trained nurses secure excellent co-operation in the matter of prevention from ignorant patients who previously had seemed impossible. In addition to her own personal instruction, she is able

to arrange for meetings for special speakers, motion picture films, etc., which stimulate much interest in the subject of tuberculosis.

The importance and the opportunities of nurses in the tuberculosis campaign have apparently failed of general appreciation, for such nurses have not been supplied in sufficient numbers. I am convinced that not less than 70 per cent. of the tuberculosis work should be done by nurses especially trained in tuberculosis. Those who are worthy should be endowed with authority to act as co-ordinators between the patient and his friends, his physician, and various public health agencies.

At present our efforts must be directed toward a greater utilization of the centers where nurses may be especially trained in tuberculosis; toward convincing nurses that great opportunities for service await them in this field; and toward convincing health organizations that many more nurses are needed to effectively carry on the campaign against tuberculosis.

The financial remuneration of nurses in tuberculosis work is reasonably satisfactory in most places. This is true also of many other workers in tuberculosis, although we must

never place too much emphasis upon financial remuneration in any health work. The service which one renders must always be given first place. It will always be true as it has been in the past that they who place service rendered first and treat their fellow-men honestly and squarely and give the very best that they have been able to obtain in a most conscientious manner will not only retain their own self-respect but will command the respect of all with whom they come in contact. Such individuals, placing service first, need have no fear of success, financial or otherwise. This thought is expressed beautifully in the following lines:

"It isn't the cut of the clothes that you wear,
Nor the stuff out of which they are made,
Though chosen with taste and fastidious care,
And it isn't the price that you paid;
It isn't the size of your pile in the bank,
Nor the number of acres you own,
It isn't a question of prestige or rank,
Nor of sinew, and muscle and bone;
It isn't a question of city or town,
Nor a question of doctrine or creed,
It isn't a question of fame or renown,
Nor a question of valorous deed;
But he who makes somebody happy each day,
And he who gives heed to distress,
Will find satisfaction the richest of pay,
For it's service that measures success."

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